GENERAL GEOLOGY REPORT G 33
1972

MINERAL COLLECTING IN PENNSYLVANIA

Cover: Photograph through a microscope by D.M. Lapham of a thin slice of serpentinite from Lancaster County showing olivine (blue-green and red), serpentine (yellow veinlets), and magnetite-limonite (black); magnified 600 times.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
BUREAU OF
TOPOGRAPHIC AND GEOLOGIC SURVEY
Arthur A. Socolow, State Geologist

BULLETIN G 33

Mineral Collecting in Pennsylvania

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PREFACE

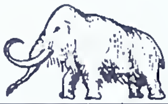
During the past 10 years, the hobby of mineral collecting has been growing at an accelerated pace. To keep up with the demand for accurate information and for new localities, we revised the first edition of "Mineral Collecting In Pennsylvania" in 1965. That second edition represented a major expansion of the number of available mineral localities for which we had detailed information. Since 1965, additional mineral data on these localities have been collected. Much of this information was provided by samples from mineral collectors. To them we express our appreciation for their assistance and cooperation.

The third edition contains seven new collecting localities not previously described. Three of these are credited to Donald Hoff, Geology Curator of the William Penn Memorial Museum. More than 40 minerals and many more accurate mineral descriptions from the previously described localities also have been added. Several minerals new to Pennsylvania are included. Any additional comments or information are welcome. As you pursue our fascinating hobby of mineral collecting we hope that you will take care in the often dangerous quarries, always seek prior permission to collect, and enjoy the sciences of mineralogy and geology.

This fourth printing is essentially unchanged from the previous edition, except that three localities, the Grace mine in Berks County, the Stillwell quarry in Lancaster County, and the Medusa Cement Company quarry in York County, are now closed to collectors.

D. M. L.
A. R. G.
1972

GEOLOGIC TIME SCALE

MILLIONS OF YEARS AGO	LIFE RECORD TYPICAL FOSSILS	ROCK RECORD PREDOMINANT ROCKS	GEOLOGIC NAMES PERIODS	ERAS
1		Glacial deposits	QUATERNARY	Cenozoic Era
70		EROSION Sands & Clays	TERTIARY	Cenozoic Era
135		EROSION Sands & Clays	CRETACEOUS	Mesozoic Era
180		EROSION	JURASSIC	Mesozoic Era
225		Shales & Sandstones Diabase intrusions	TRIASSIC	Mesozoic Era
270		EROSION Shales, Sandstones, Coals, & Limestones	PERMIAN	Paleozoic Era
310			PENNSYLVANIAN	Paleozoic Era
350			MISSISSIPPIAN	Paleozoic Era
400		Shales, Red beds, Sandstones, & Limestones	DEVONIAN	Paleozoic Era
440			SILURIAN	Paleozoic Era
500		Shales & Sandstones	ORDOVICIAN	Paleozoic Era
600		Limestone & Dolamite Sandstone	CAMBRIAN	Paleozoic Era
	ALGAE	EROSION Granites, Gneisses, & Schists	PROTEROZOIC ERA	Precambrian Time
4000+			ARCHEOZOIC ERA	Precambrian Time

ORIGIN OF THE EARTH

CONTENTS

ILLUSTRATIONS

INTRODUCTION

In recent years, mineral collecting has become a hobby for an increasingly large number of people. The Pennsylvania Geological Survey hopes that this booklet will help to stimulate this interest in mineral collecting by providing recent information on good collecting localities. We are not attempting an exhaustive treatment of Pennsylvania's mineral occurrences, such as Samuel G. Gordon's report, "The Mineralogy of Pennsylvania", published in 1922, or the revision by Professor Arthur Montgomery (1969). Rather we have selected a small number of localities based on the abundance and variety of minerals which can be found there today. Many old and famous localities are now "barren" as far as the "rockhound" is concerned. These have been excluded. On the other hand, new occurrences of significance have been discovered, and are described here.

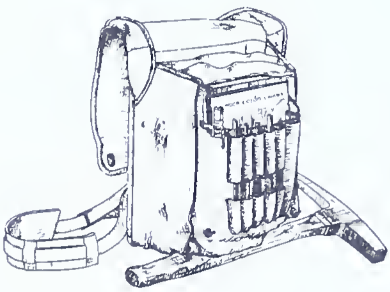
Since mineral collecting and the science of mineralogy are a part of the more inclusive science of geology, we have included brief summaries of the geology of each occurrence. Definitions of some geological terms and processes also have been included to help make this geological discussion more useful and meaningful to the mineral collector.

There is one warning we would like you, the rockhound, to heed. Ask permission from the owners of the land, or from the quarry and mine operators, before entering to collect. This will ensure good will between you and the land owners. In the case of operating quarries or mines, it will also add to your safety, since supervision of collectors is often required under company policy. In the past, the abuses of inconsiderate collectors have caused many excellent localities to be closed to the public. Do not be a trespasser.

MINERAL COLLECTING

Always Ask Permission to Collect!

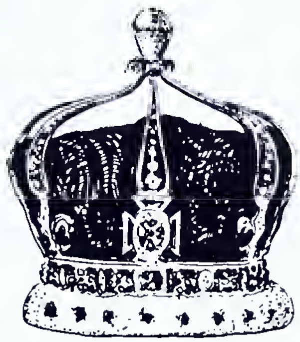
The study of rocks and minerals is an important part of the science of geology. These same rocks and minerals which we see each day along the road, in our garden, and when we go for a hike in the woods, are so familiar that in many cases we do not bother to learn even their names. And just as each has a different name, so does it have a distinct "personality." If from this day on you will pick up these rocks and minerals, learn their names, and whatever else you can about them, you will find that the earth we live on is a fascinating world. Join the ranks of the thousands of "rockhounds" who have discovered that mineral collecting is an exciting hobby.



The crust of the earth is made up of MINERALS—more than 2000 different kinds. Many of these are rarely seen because they are buried deep below the surface. Without both the soft and the resistant minerals, there would be no broad, majestic river valleys or towering mountains and rolling hills. Even the soils which underlie dense forest growths and undulating farm lands are made up of mineral fragments weathered from rocks.

The world of man-made articles relies on the elements obtainable from minerals. In glass making, from the commonest bottle glass to the most expensive, decorative, colored glassware, the mineral quartz is the source for silicon and oxygen. The metals of cars, steel-girdered buildings, and complicated technical machinery are possible only through the efforts of men tunneling, scraping, and digging into masses of rock in search of valuable iron-rich minerals. Every step of our modern existence is aided by the knowledge and exploitation of mineral resources. Every new technological advance cries out with the need for more minerals. Often, it is the amateur collector or the prospector who finds them.

As GEMS, minerals have captured imaginations from the earliest civilizations down to the present time. In combining beauty with rarity, man has never excelled nature's own mineral production.



The unique shapes, variety of color, and individuality of minerals initiated the intriguing hobby of mineral collecting. It began many thousands of years ago and has grown today to a major hobby in which the whole family often participates. Minerals are within walking or driving distance of everyone. Thanks to nature's generosity the cost of collecting them is no more than a little time and gasoline. Many minerals remain waiting to be discovered; the collector has an opportunity to be the first human being to see that particular crystal.

The rocks and minerals you will find at the localities in this book are only a beginning, an appetizer, to what we hope will become both a fascinating and educational exploration into a scientific field which has a long romantic history and an alluring future.

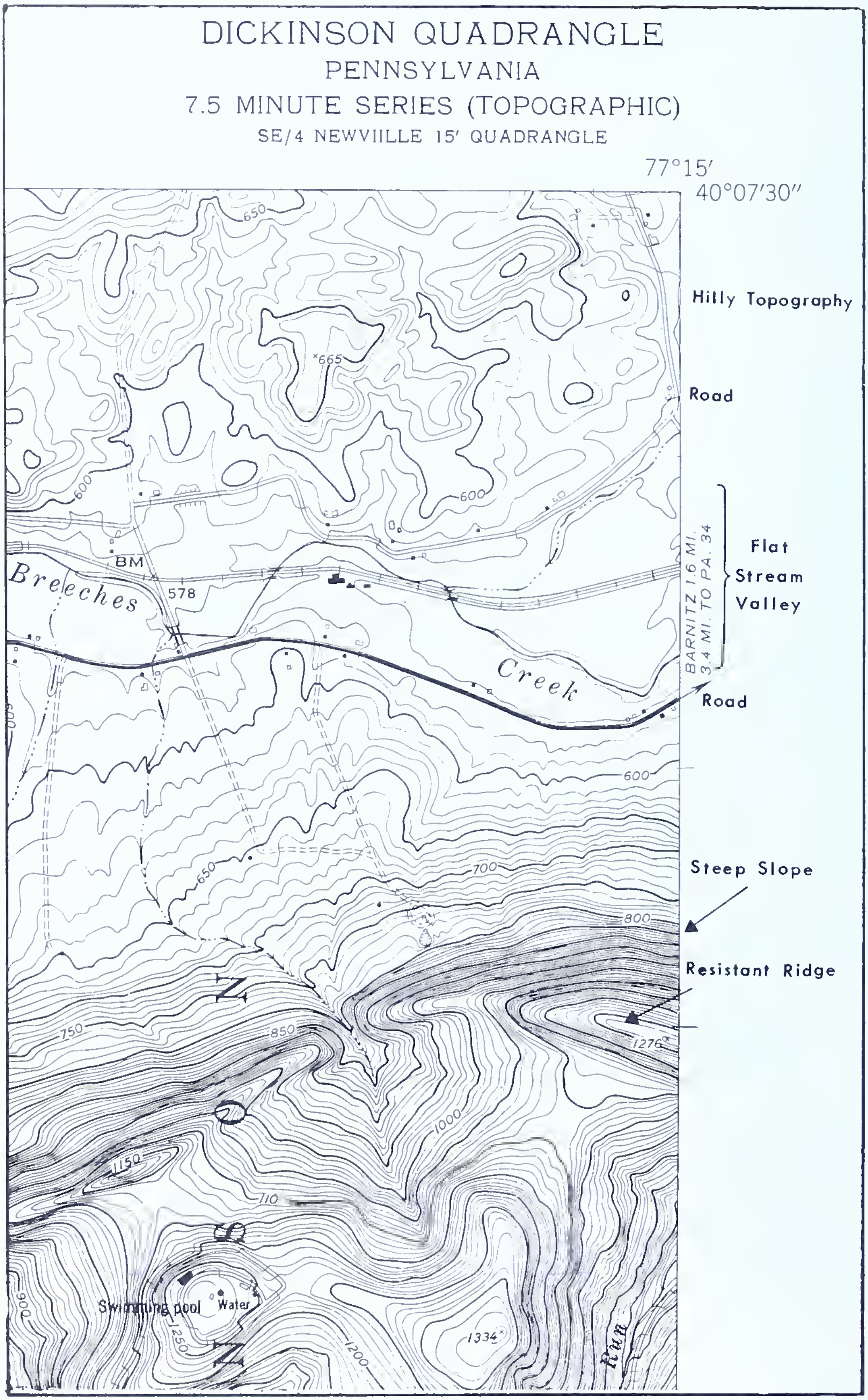
TOPOGRAPHIC MAPS

The first necessity for a mineral collecting expedition is a knowledge of how to get there. The second is a knowledge of where to look. If the mineral collector can understand the information given on a topographic map, the location of a mineral site designated by quadrangle and rectangle will pose no problem. An example is the locality for limonite pseudomorphs after pyrite found near Columbia in Lancaster County, described in this report. If the only description of its location were given as "about three miles east of Columbia, Pennsylvania," the anxious mineral collector might traverse many weary miles and spend many discouraging hours before he arrived, if ever, at the collecting locality. However a topographic map not only narrows down the area of search, but it also contains the shapes and names of land features by which an exact pin-pointing of the locality may be made.

A topographic map is the representation of the relief, or "ups and downs," of the land surface, along with roads, houses, political boundaries, and geographic place names—such as Chestnut Hill at the limonite pseudomorph locality. One topographic map, regardless of the area it covers, is referred to as a quadrangle. It is subdivided into nine equal areas, called rectangles. Brown contour lines on a topographic map represent lines of equal elevation, and tell us where the hills, valleys, and flat lands are; the more closely spaced these lines are, the steeper is the slope.

The topographic maps of the United States Geological Survey are printed in color; culture in black, contours in brown, and water in blue. The cultural features, such as houses, roads, railroads, county boundary lines, and dams, are the works of man. On the mineral collecting locality maps in this booklet, taken from U. S. Geological Survey maps, the colors are not shown, but you should not have much difficulty in telling culture, contours and rivers apart. A key to the conventional signs used on the map is printed on the reverse side of some U. S. Geological Survey maps. A booklet describing topographic maps and symbols may be obtained free of charge by writing to the Map Information Office, U. S. Geological Survey, Washington, D. C. In the

actual making of a topographic map the surveyor first decides on a convenient scale. He then finds the elevation of every point where the slope of the land changes and notes these on the map, in the field. A contour interval is then decided upon; for example, 20 feet, as is the case on most topographic maps of Pennsylvania. All points then 20 feet above sea level will be connected by a continuous line, called a contour. The same will be done for all points 40 feet above sea level, and so forth, until the entire map is covered with contours.


DICKINSON QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SE/4 NEWVIILLE 15′ QUADRANGLE
77°15′
40°07′30″
Hilly Topography
Road
Flat
Stream
Valley
Road
Steep Slope
Resistant Ridge
BARNITZ 1.6 MI.
3.4 MI. TO PA. 34
Breeches
Creek
BM
578
650
665
600
700
800
750
850
1000
1150
1276
1200
1250
1334
Swimming pool
Water
Run

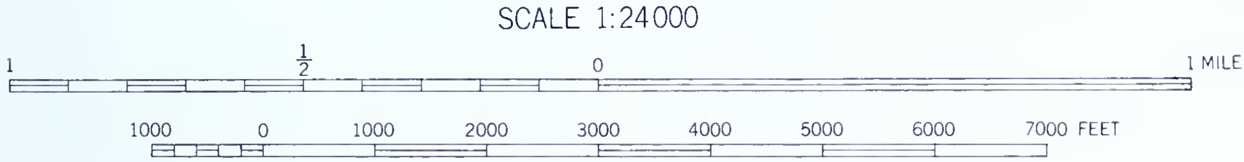
When you become accustomed to reading contour maps, you can quickly read the irregularities of the surface, almost as well as if the map were a three-dimensional model.

In general, two of the following three types of scales are represented on most quadrangles. The three are fractional, verbal, and graphic.

The fractional scale is a ratio such as 1:24,000. It means that one linear unit such as one inch on the map equals 24,000 linear units on the earth's surface. Thus one inch on the map represents 24,000 inches on the earth's surface. Note that 24,000 inches equals 2000 feet.

The verbal scale is probably more familiar than any of the other scales. It is expressed as "one inch equals 2000 feet."

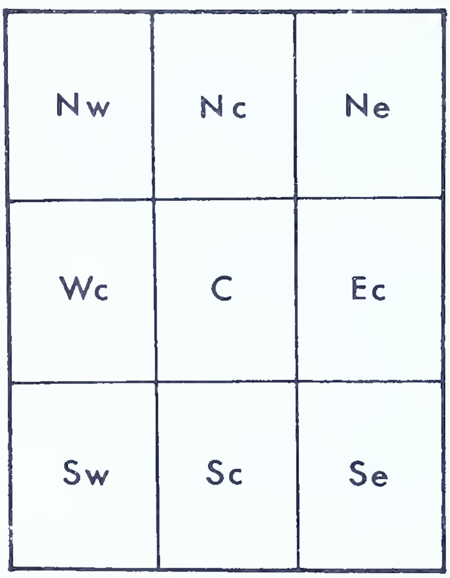
The graphic scale consists of lines that are divided into units of miles or feet. This bar or graphic scale may be used directly in measuring distances on the map with a ruler.



Wherever possible, maps on a scale of 1:24,000 (7½-minute quadrangles) have been used to locate mineral localities in this booklet. This scale is more than twice as large as the 1:62,500 (15-minute quadrangle) and shows a smaller area in much greater detail. Quarries, mines, open pits, deep gullies, and roadcuts are effectively illustrated on this series of maps. Unfortunately they are not available for all of Pennsylvania at the time of this writing, but the southeastern part of the state is completed. An index of topographic maps available for Pennsylvania may be obtained free of charge from the Bureau of Topographic and Geologic Survey, Department of Environmental Resources, Harrisburg, Pennsylvania. Individual maps, however, must be purchased from the U. S. Geological Survey, Washington, D. C., or from an authorized local dealer.

The first use a "rockhound" will have for a topographic map will be to locate himself or to locate a particular place. Of the many methods of describing locations that are used with different types of maps and in different areas, only one will be discussed here.

The boundaries of all U. S. Geological Survey topographic maps or quadrangles are parallels of latitude (east-west lines) and meridians of longitude (north-south lines). The exact degrees of each are given on each corner of all quadrangle maps. In addition to these corner markings there are tick marks on the 7½-minute quadrangle maps for every two and one-half minutes of latitude and longitude. These marks, or ticks, subdivide the map into nine convenient rectangles for ready reference. These rectangles are referred to as the northwest, the north-central, the northeast, the west-central, the central, the east-central, the southwest, the south-central and the southeast rectangles. Also, if a greater degree of accuracy is desired, each individual rectangle can further be subdivided into four or even nine more divisions, similiar to the original nine, and so on.



The location descriptions given for each mineral collecting locality use this system of pin-pointing deposits. In addition to the topographic map descriptions, a small map showing the immediate area around each collecting locality is given. These have been taken from topographic quadrangles. A quarry or mine symbol designates the exact mineral location.

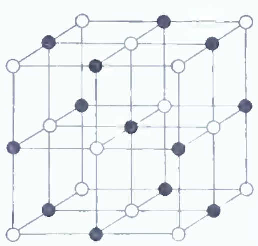
TOPOGRAPHIC MAP SYMBOLS

- Hard surface, heavy duty road, four or more lanes
- Hard surface, heavy duty road, two or three lanes
- Hard surface, medium duty road, four or more lanes
- Hard surface, medium duty road, two or three lanes
- Improved light duty road
- Unimproved dirt road—Trail
- Railroad: single track—multiple track
- Tunnel: road—railroad
- Overpass—Underpass
- Buildings (dwelling, place of employment, etc.)
- School—Church—Cemeteries — Cem
- Buildings (barn, warehouse, etc.)
- Power transmission line
- Telephone line, pipeline, etc. (labeled as to type)
- Horizontal and vertical control station:
  - tablet, spirit level elevation — BM △ 3899
  - other recoverable mark, spirit level elevation — △ 3938
- Boundary: national
  - state
  - county, parish, municipio
  - civil township, precinct, town, barrio
  - incorporated city, village, town, hamlet
- Open pit, mine, or quarry
- Shaft—Tunnel entrance
- Index contour
- Intermediate contour
- Supplementary contour
- Depression contours
- Fill
- Cut
- Levee
- Levee with road
- Mine dump
- Wash
- Tailings
- Tailings pond

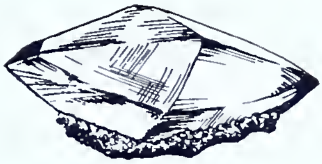
MINERALS

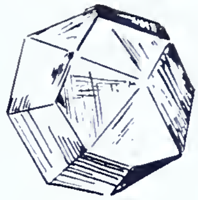
DEFINITION

A mineral is usually formed by natural inorganic processes, has either a fixed chemical composition or a composition which is variable within narrow limits, and generally possesses a characteristic atomic structure. Minerals are usually formed by *natural* means but also have been reproduced by man, especially gems and industrial minerals, for example diamond, quartz, and corundum. These are called synthetic minerals. Although minerals are usually formed by *inorganic* processes (including such rarities as coesite from the impact force of a meteorite) they may also be formed by organic ones as in the case of phosphate minerals formed from bird guano and the carbonates of clam shells. The more mineralogists study the exact *chemical composition* of minerals the fewer are the minerals found which have the same fixed chemical composition. A *characteristic atomic structure* means that minerals have a regular arrangement of atoms beneath their surface; this regular arrangement results in the growth of crystals with definite shapes. Frequently these crystals are too small to be seen with the naked eye and the material appears to be massive. Vein quartz is a good example. Rarely, as in opal and deweylite, the atoms are irregularly arranged and consequently no single crystals are possible.



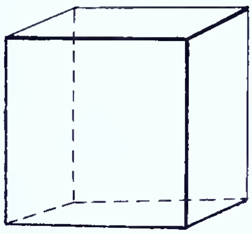
Atomic Model—Halite



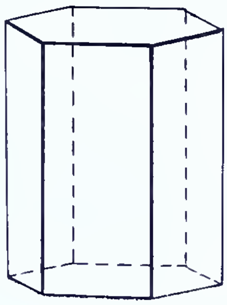


CRYSTALS

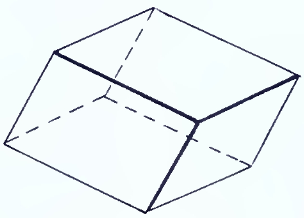
A mineral may be identified by certain properties or characteristics that it possesses. Some minerals are easily identifiable while others require careful examination and often chemical, thermal, or X-ray analysis. One of the simplest means of identification is by an examination of crystal form. A crystal has a consistent shape bounded by planar surfaces (faces) which are an outward expression of the internal arrangement of atoms. Different crystal faces have different atoms or a different arrangement of atoms beneath them which gives rise to surfaces



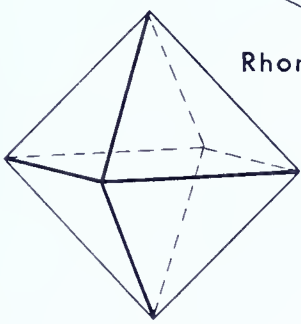
Cube



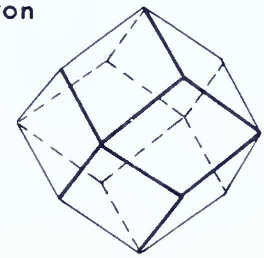
Prism



Rhombohedron



Octahedron

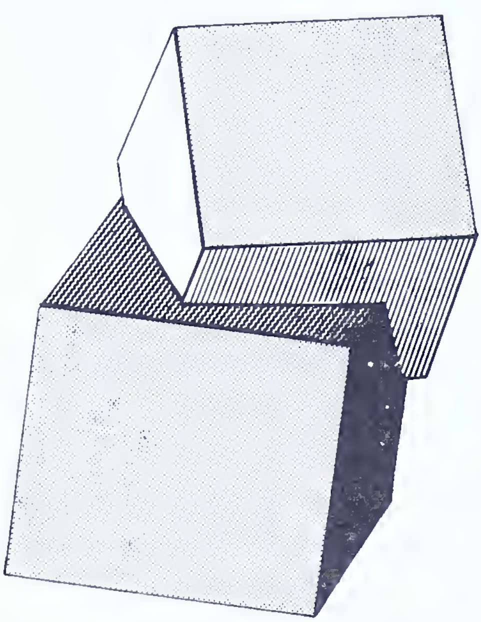


Dodecahedron

of varying shapes and sizes. Crystals are formed by crystallization from solution, fusion, or vapor condensation. An example of crystals formed from solution is the formation (precipitation) of crystals of salt which occurs when a salt solution, such as sea water, is evaporated. The most familiar example of crystallization by fusion is the formation of aggregates of ice crystals under the pressure of freezing water. The third method of crystal formation, from a vapor, is characterized by the formation of snow flakes. This happens when air, containing large amounts of water vapor, is quickly cooled and snow crystals form directly from the vapor.

Crystal forms are described by such common names as cube and pyramid, and by less common names such as prism (an elongated form), octahedron (8-sided form), dodecahedron 12-sided form), and rhombohedron (6-sided form whose faces are parallelograms). Well-developed crystals, however, are not common because conditions of growth must be just right for their formation. In many cases the crystals found will be distorted and probably have a combination of several forms. Often two or more crystals will be intergrown; that is, the crystal of one will appear to have grown out of the side of another. These are called penetration *twins*. Some of these terms describing crystal shapes are mentioned in this book when they are of special interest to mineral collectors.

Cube Penetration Twin

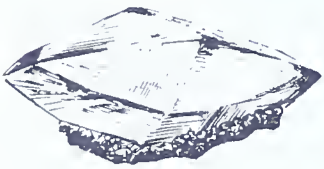
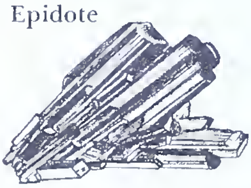
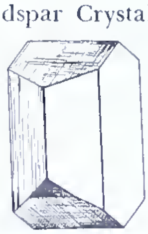


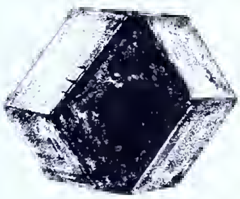
MINERAL ASSOCIATIONS

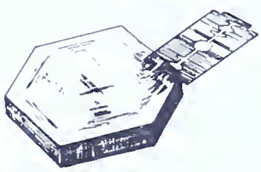
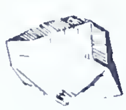
Nature is generally quite orderly in everything she does and the occurrence of rocks and minerals is no exception. Every mineral is made up of one or more elements like chromium, oxygen, silicon, nickel, etc. Certain of these elements occur together in nature, not always in the same mineral, but in different minerals, and are then found by the collector, usually in association with each other. Sometimes this association helps in identifying a mineral by excluding many similiar-appearing minerals. This fact is also very important to the collector. When he visits, for example, a galena locality, he also will expect to find the mineral sphalerite as well as carbonates and sulfates of both lead and zinc because lead and zinc minerals form under the same geologic conditions. In addition to the common association of certain minerals they also crystallize in particular kinds of rocks. Native gold for instance is very rarely found in sedimentary limestone but often found in igneous vein quartz. Nickel minerals again would not be expected in sandstones and shales but rather in basic igneous rocks such as gabbro, norite, and dunite. Each such association is a clue to the origin of that mineral. The following table is presented for the beginning mineral collector so that he may better understand typical mineral associations and the host rocks in which they occur.

MINERAL ASSOCIATION TABLE

Mineral	*Associated Minerals*	*Enclosing Rocks*
Amphiboles Tremolite Actinolite Hornblende	Quartz Mica Epidote Feldspar Chlorite Magnetite Ilmenite Rutile	Metamorphic Rocks: Schist Gneiss Hornfels Igneous Rocks: Pegmatite Diabase Gabbro

Mineral	*Associated Minerals*	*Enclosing Rocks*
Beryl 	Tourmaline Quartz Mica Feldspar	Metamorphic Rocks: Schist Igneous Rocks: Granite Pegmatite
Calcite Crystals 	Aragonite Celestite Dolomite Pyrite Siderite Strontianite Quartz Chalcopyrite	Sedimentary Rocks: Limestone Igneous Rocks: Pegmatite Diabase
Carnotite	Autunite "Gummite" Carbon Vanadium and Copper minerals	Igneous Rocks: Pegmatite Sedimentary Rocks: Sandstone Siltstone Shale
Chromite	Olivine Magnesite Serpentine Talc Chlorite	Ultrabasic Igneous Rocks: Peridotite Dunite Serpentinite
Clays	Mica Chlorite Feldspar Quartz	Sedimentary, Igneous and Metamorphic; usually from erosional weathering
Epidote 	Clinozoisite Quartz Mica Chlorite Hornblende Garnet Feldspar	Metamorphic Rocks: Schist Gneiss Hornfels Igneous Rocks: Pegmatite
Feldspar Crystals 	Beryl Quartz Chlorite Mica Calcite Tourmaline Clay minerals	Igneous Rocks: Pegmatite Granite Sedimentary Rocks: Sandstone Metamorphic Rocks: Schist

Mineral	*Associated Minerals*	*Enclosing Rocks*
Galena 	Silver Sphalerite Pyrite Barite Anglesite Cerussite Pyromorphite Marcasite Calcite Dolomite	Sedimentary Rocks: Limestone Dolomite Chert Igneous Rocks: Quartz or carbonate veins Lead, copper, and zinc ore deposits
Garnet 	Vesuvianite Feldspar Mica Quartz Kyanite Hornblende Staurolite Chlorite Tourmaline Epidote Diopside	Metamorphic Rocks: Marble Schist Gneiss Metabasalt and Metadiabase
Graphite	Calcite Diopside Garnet Quartz Mica	Metamorphic Rocks: Schist Marble Gneiss
Limonite	Phosphate minerals Clay minerals Pyrite Manganese minerals Marcasite Hematite Goethite Lepidocrocite	Sedimentary Rocks: Impure limestone Shale or clay Sandstone Iron-rich Igneous and Metamorphic Rocks
Magnetite	Pyrite Chalcopyrite Pyrrhotite Chromite Ilmenite Chlorite Actinolite Hematite Calcite	Metamorphic Rocks: Marble Schist Gneiss Igneous Rocks: Diabase Ultrabasics Granite

Mineral	*Associated Minerals*	*Enclosing Rocks*
Marcasite	Pyrite Sphalerite Wurtzite Galena Limonite Calcite	Sedimentary Rocks: Shale Clay Igneous Rocks: Veins Ore deposits
Mica 	Quartz Feldspar Chlorite Beryl Tourmaline Clay minerals Garnet	Igneous Rocks: Granite Pegmatite Metamorphic Rocks: Schist and Gneiss Sedimentary Rocks: Shale and Clay
Native Copper	Chalcopyrite Malachite Azurite Cuprite Limonite Zeolites Epidote Chlorite Native Silver	Sedimentary Rocks: Conglomerate Igneous Rocks: Greenstone, Basalt, Andesite, Rhyolite Ore deposits
Quartz Crystals 	Feldspar Calcite Tourmaline Beryl Mica Chlorite	Sedimentary Rocks: Sandstone Limestone (impure) Igneous Rocks: Pegmatite Rhyolite (vugs) Metamorphic Rocks: Quartzite
Talc	Chlorite Magnetite Serpentine Tremolite Mica Magnesite	Igneous Rocks: Ultrabasics and Serpentinite Metamorphic Rocks: Altered dolomite Schist (rarely)
Zeolites 	Chlorite Pyrite Aragonite Fluorite Feldspar Calcite Actinolite	Igneous Rocks: Basalt and Diabase Sedimentary Rocks: Limestone and Shale (rare)

REVISIONS OF MINERAL NAMES

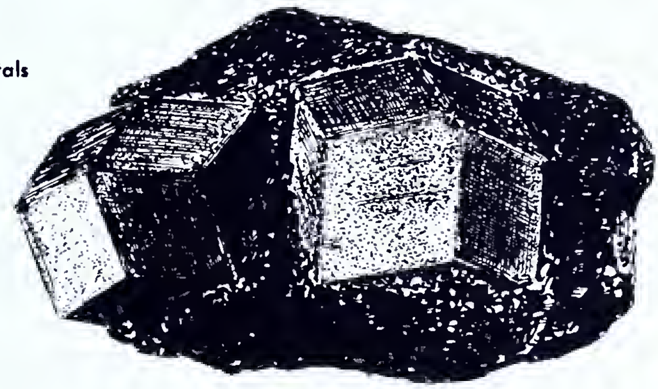
In 1960, the Commission On Mineral Names made its first report of recommendations to the International Mineralogical Association. This commission hopes to set the international standards for mineral names, to pass on the definitions of new minerals, and to delete names for discredited minerals. The complete changes for 1959-1961 may be found in the Jan.-Feb. 1964 issue of the American Mineralogist, vol. 49, p. 223-224. Below are listed changes for the more common names. New names, where applicable, are used in this book.

Disapproved or Discredited: hydroamesite, hydroantigorite, pseudonatrolite, doverite, delatoreite, deltaite, shattuckite, woodfordite

Name Corrections:

Analcime, not analcite
Anatase, not octahedrite
Bromargyrite, not bromyrite
Chlorargyrite, not cerargyrite
Gibbsite, not hydrargillite
Grossular, not grossularite
Hemimorphite, not calamine
Iodargyrite, not iodyrite
Magnesite, not giobertite
Piemontite, not piedmontite
Spessartine, not spessartite

Garnet Crystals



William Penn Memorial Museum, Harrisburg
Photo by Historical and Museum Cammissian, Harrisburg

ORGANIZING A COLLECTION

There are three important steps, of which the beginning mineral collector is often unaware, between the field trip and the final resting place of a specimen in the mineral collector's cabinet. In order of performance these are 1.) immediate labeling in the field of the location of each specimen, 2.) the accurate identification of all minerals on each sample, and 3.) an orderly scheme of classification, arrangement, and data filing for the whole collection. The last two steps can best be performed at home where ample time is available for a thorough study of the minerals which were collected.

Exact location data include the nearest town, the property, quarry, or mine name, and the date when the samples were found. There are many reasons why this information is vital, why it enhances the interest and the value of a mineral collection.

The most obvious is that other individuals will be curious where a particular specimen was found, particularly if it is an unusual mineral. They may want to visit the locality themselves. Secondly, although a particular mineral may not be rare, it may be rare for that locality. This adds considerable value to the specimen, especially for any collector who is trying to collect a complete mineral suite from one location, and there are many such who have discovered the fun of locality specialization. Another type of specialization, that of collecting crystal variations within a mineral group from many different localities, also requires accurate location data. For example, many collectors specialize in quartz and calcite varieties, but collections of groups of minerals such as the zeolites, the micas, or the feldspars also are interesting and will be more unusual. Finally, there is the added geologic story which a known location adds to each specimen collected. Often a glance at the mineral and the location label will bring to mind the whole geologic picture of a collecting site. The descriptions given in this book are merely an introduction. Many Pennsylvania localities are world famous and have been described in great detail in other publications for the advanced collector and scientist to pursue further.

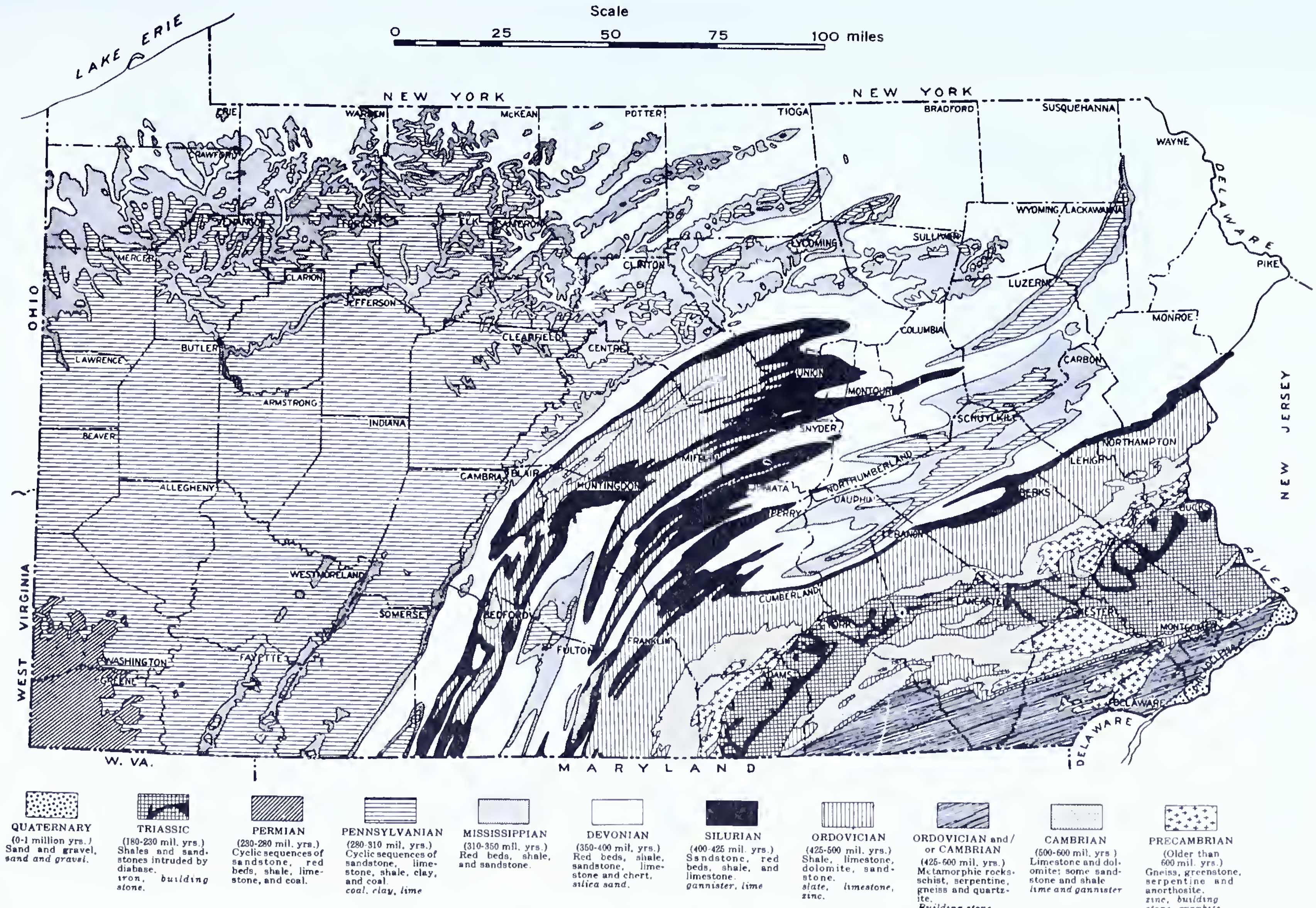
REF. NO.	COUNTY:	DATE:
LOCATION:		
NAME AND NOTES:		
COLLECTOR:	NOTEBOOK:	PAGE AND REF:

The second step, that of accurate mineral identification, cannot be overemphasized. Far too often, minerals have been casually misidentified, the name has spread, and eventually found its way into print where it is taken for fact. There are relatively few minerals which can be positively identified at a glance, even by advanced collectors. Here is where a knowledge of geology, especially the exact location of a mineral in question,

is particularly useful. This facet of identification is amplified in the chapter on mineral associations. If a mineral name is in question, the best procedure is first to make simple identification tests such as those for color, streak, crystal form, hardness, reactivity to hydrochloric acid, and luster. Frequently more advanced tests such as specific gravity, optical properties, or X-ray characteristics will be necessary. Always remember that the identification by another collector of any but the most common minerals can only be considered probable at best. If possible, send any sample still in question to a professional mineralogist at a nearby university or to the Bureau of Topographic and Geologic Survey for a free examination. However, the collector should first exhaust all his own knowledge and techniques of identification. This is an important part of the joy of mineral collecting. Many references are available to aid in identification; some of them are listed in this book.

The third step is that of classification. Most collectors eventually find that they are forced to use the Dana system, which is both a chemical and structural scheme. More recently there has been an increased emphasis on classification by atomic structure, especially for the silicates. A good text for this is "Mineralogy" by Berry and Mason, published by W. H. Freeman & Co., 660 Market Street, San Francisco 4, California. Such a classification provides an orderly, consistent arrangement of minerals. However, other systems and cross-filing are often useful. For example, special cards for mineral displays by location or by mineral origin can be useful, fascinating, and instructive. To do this, each mineral should be numbered, preferably not with paint but with gummed labels, and the numbers recorded together with location and date in a sequential log. Most advanced collectors also cross file all samples by a card system which corresponds to their cabinet arrangement, usually the Dana chemical system. Each collector will devise the system which fits his collection best, but these cardinal points should be considered.

GEOLOGIC MAP OF PENNSYLVANIA



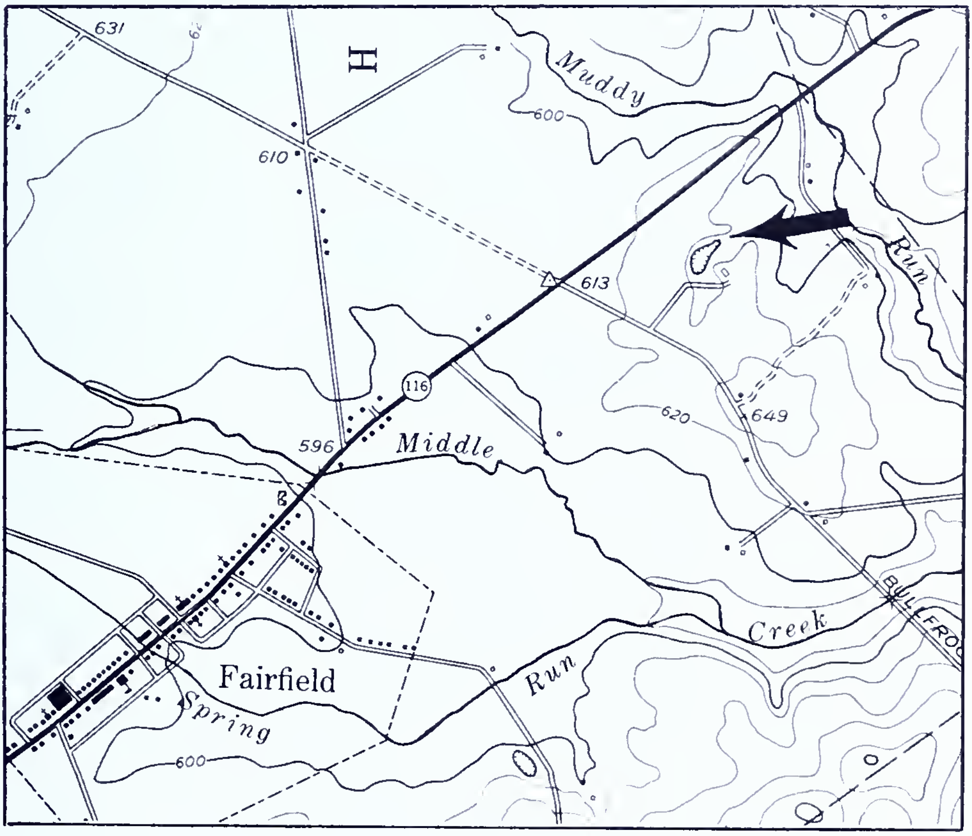
SELECTED MINERAL COLLECTING LOCALITIES

ADAMS

GARNET-ZEOLITE LOCALITY

LOCATION

This quarry is located on State Route 116, approximately 0.7 mile northeast of the Route 116 bridge over Middle Creek, near Fairfield, Hambiltonian Township. For the collector familiar with topographic maps, this quarry is located in the southwest rectangle of the Fairfield 7½-minute quadrangle. It is operated by Gettysburg Limestone Producers Inc. and permission to collect must be obtained from the company.



MINERALS

Apophyllite: white crystals
Calcite: massive, cleavages, crystals (small)
Chalcopyrite: massive; associated with calcite
Garnet: most commonly in partial crystals, usually green; probably andradite

GEOLOGY

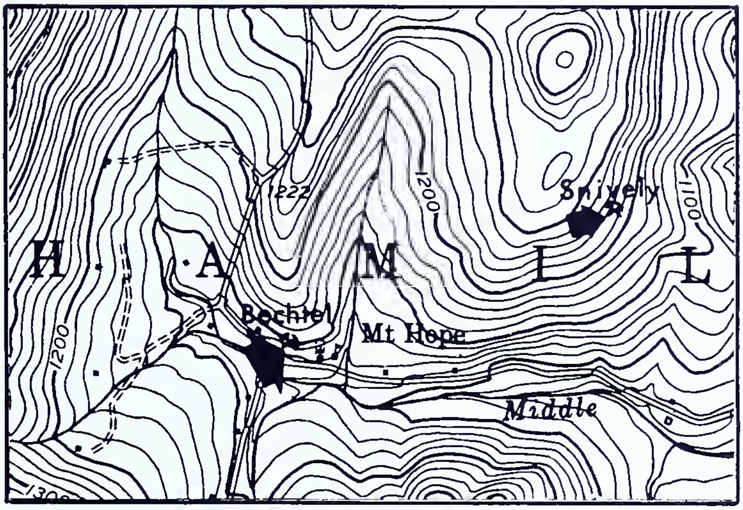
The quarry is located in limestone conglomerate of Triassic age. The minerals are metamorphic (garnet) and secondary alteration products (calcite, apophyllite) of the host rocks.

NATIVE COPPER LOCALITIES

LOCATION

The best native copper collecting localities in Pennsylvania are located in southwestern Adams County. The individual abandoned mines are located in the central and south-central rectangles of the Iron Springs 7½-minute quadrangle. Permission must be obtained to collect from these mines. The exact location of each mine is given below and shown on the topographic maps illustrated below.

The Snively mine is located approximately ¼ mile northeast of Mount Hope, on the east side of the mountain. Mount Hope is located in the center rectangle of the Iron Springs quadrangle.



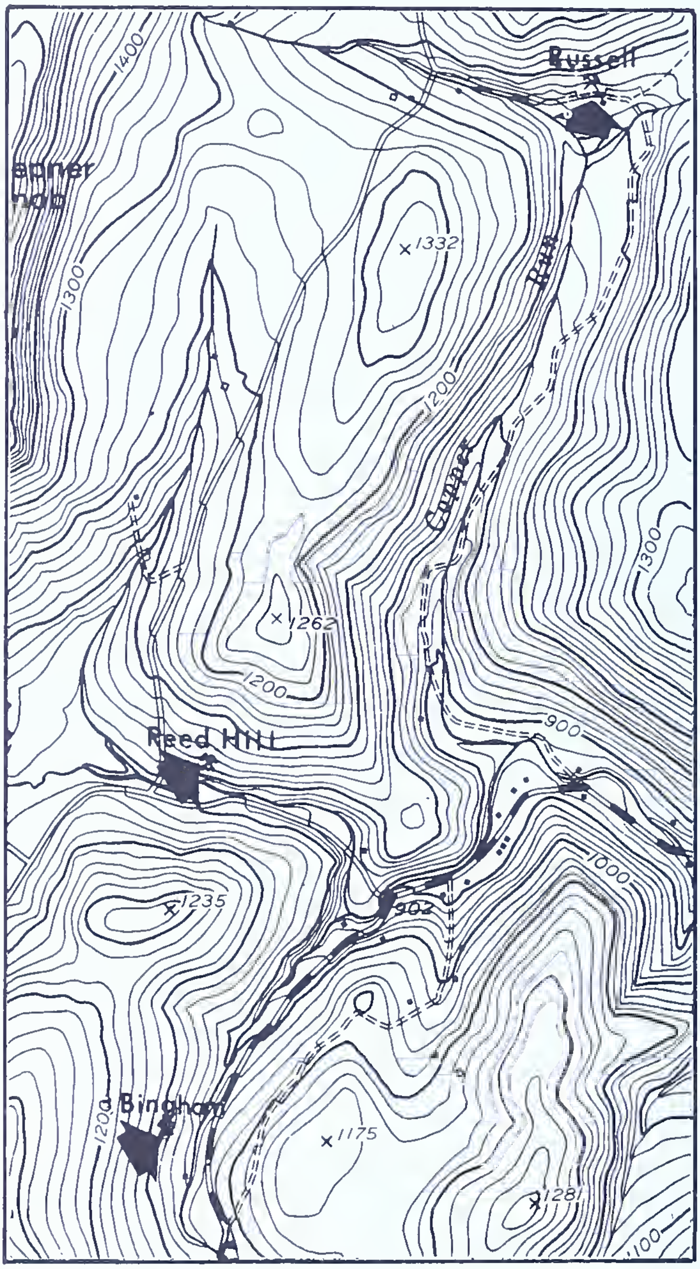
The Bechtel mine is located at the town of Mount Hope.

The Russell mine is located approximately one mile due south of Mount Hope, just north of the lake at the head of Copper Run and north of the east-west road near this mine, in the northern half of the south-central rectangle.

The Reed Hill mine is located about two miles west of Maria Furnace and Iron Springs, on the north side of Toms Creek, in the south-central rectangle.

The Bingham mine is located about ½ mile northeast of Pine Mountain, just west of the road between Gladhill and Maria Furnace, in the south-central rectangle.

Permission to collect at the Bingham Mine must be obtained from the caretaker.



The Virgin mine is located approximately ¾ mile west of Pine Mountain and just west of the Franklin-Adams County boundary.

MINERALS

Asbestos: amphibole and probably chrysotile; small fibers
Azurite: small crystals and coating
Bornite: rare; coating on chalcocite
Chalcocite: rare; massive
Chlorite: variety prochlorite; massive and small crystal flakes; common
Copper (Native): occasionally found in crystals; usually wire form
Cuprite: rarely in crystals
Epidote: generally massive, common; pink variety, piemontite (piedmontite) rare, on Pine Mountain
Hematite: generally earthy
Malachite: small crystals and coating
Quartz: small crystals, uncommon

Most interesting collectable material:
Native copper
Copper-rhyolite: a rock cut and polished for cabochons containing epidote and copper minerals with quartz

Native Copper

GEOLOGY

The native copper occurs as wires, leaves, and small masses. The minerals all occur in basalt. Because of the presence of much epidote and chlorite in the basalt, the rock is often called a greenstone. This basalt was at one time a lava flow. Gases escaping from the lava flow as it cooled made small cavities, called vesicles, in the basalt which have since been filled with the copper and other minerals. Fractures in the lava have also been mineralized. These lava flows are at least 600 million years old (Precambrian age).

Native copper is a primary mineral, meaning that it formed directly from a solution before the other copper minerals. Most of the other copper minerals formed from the native copper by low temperature or surficial alteration. These are termed secondary minerals.

SIMILAR OCCURRENCES

The Keweenawan copper deposits of Michigan.

SELECTED REFERENCES

Baily, J. T. (1883), *The copper deposits of Adams Co., Pennsylvania,* Eng. Min. Jour., v. 35, p. 88.

Bevier, G. M. (1914), *The present status of the copper development in the South Mountain region,* Pa. Geol. Survey, Biennial Rept., Appendix C.

Stose, G. W. (1910), *The copper deposits of South Mountain in southern Pennsylvania,* U. S. Geol. Survey Bull. 430, p. 54.

———and Bascom F. (1929), *Fairfield-Gettysburg folio, Pa.,* U. S. Geol. Survey Folio #225, 34 p.

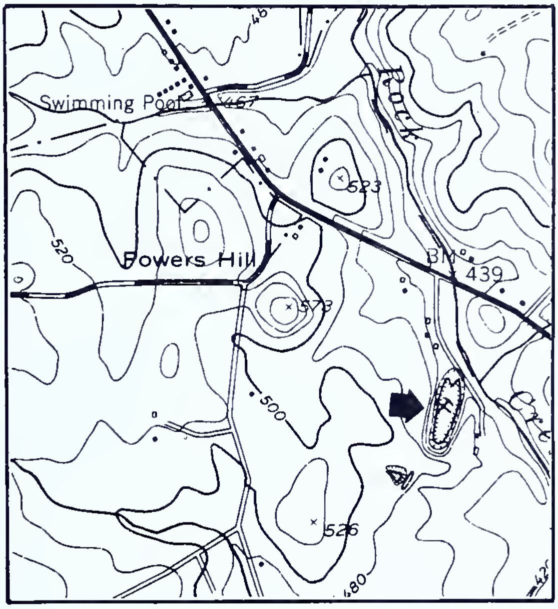
Wherry, Edgar T. (1911), *The copper deposits of Franklin-Adams Counties, Pennsylvania,* Jour. Franklin Institute, p. 151-163.

Native Copper—Dendritic

ZEOLITE LOCALITY

LOCATION

The Teeter Stone Company quarry is located along U. S. Route 140, approximately 2.4 miles southeast of Gettysburg, Adams County. On the Gettysburg 7½-minute topographic map, the quarry lies in the southeast corner of the west-central rectangle. Quarrying operations are active and it is absolutely necessary to obtain permission to enter and collect.



MINERALS

Calcite: white to tan colored rhombohedral crystals and cleavage rhombs; fluorescent; rare

Chabazite: flesh-colored rhombs

Chalcocite: small masses altering to malachite; rare; in sandstone

Epidote: massive and small, prismatic crystals

Hematite: variety specular

Heulandite: rare crystals

Limonite pseudomorphs after pyrite; rare; in hornfels

Malachite: coating
Natrolite: small white crystals; uncommon
Pyrite: cubic crystals in hornfels; rare
Pyrolusite: dendrites
Quartz: generally vein material
Stilbite: white to pale yellow sheaves and single crystals; also in white stellate rosettes originally misidentified as pectolite

GEOLOGY

The quarry is located in the Gettysburg shale of Triassic age (about 90 million years old). At this particular site the shale is very close to an intrusive igneous diabase sheet and has been literally baked by the diabase intrusion at the time of its emplacement. This baked rock that the collector sees today should not be called a shale but rather a hornfels. The zeolite minerals were deposited along both open and tight fractures and between rock fragments where the rock was brecciated (meaning "fragmented") as an indirect result of the intruding diabase magma. These minerals crystallized out of solution shortly after the diabase solidified. Malachite and pyrolusite are the result of later mineral deposition from percolating ground water, and are called secondary minerals. The geology here is similar to that at Dillsburg, described in this book.

ALLEGHENY

WURTZITE LOCALITIES

LOCATION

There are several localities for wurtzite in Allegheny County, as well as in Indiana, Armstrong and Westmoreland Counties. Several of the most productive are listed here and include localities taken from the article by David Seaman and Howard Hamilton (1950) listed below. The locality numbers correspond to those used by Seaman and Hamilton.

3. In a railroad cut along the main line of the Pennsylvania Railroad just east of the station at Donohoe, approximately four miles east of Greensburg, Westmoreland County; the Latrobe quadrangle, southwest rectangle. About one in four concretions contain wurtzite crystals.
7. At the old brickyard Quarry at Valley Camp, Westmoreland County; the New Kensington West 7½-minute quadrangle, the northeast rectangle.
9. At the Glassmere Brick Co. quarry at Glassmere, Allegheny County; the New Kensington West 7½-minute quadrangle, the east-central rectangle.
11. At the Baltimore and Ohio Railroad cut at Wittmer, about two miles north of Etna, Allegheny County, and along Route 8, the Glenshaw 7½-minute quadrangle, the south-central rectangle. About one in ten concretions contain wurtzite crystals.

MINERALS

Barite: in concretions
Calcite: in concretions
Chalcopyrite: small tetrahedrons
Marcasite: usually not distinguishable
Pyrite: small cubes
Sphalerite: massive cleavages and occasional crystals
Wurtzite: crystals

Most Interesting Minerals:

Small crystals of wurtzite up to 2 mm or 3 mm in diameter; of a brownish-red color; the forms are hexagonal pyramids and rhombohedral (trigonal) crystals; embedded in calcite or barite concretions.

GEOLOGY

The wurtzite, sphalerite, chalcopyrite, and pyrite are found along small fractures or cracks, either in calcite or barite concretions. Most of the concretions are ovoid, and range from two to five inches in length. The concretions are found in carbonaceous clay-shale lenses above a limestone. The minerals are believed to have formed in the clayey muds of an ancient sea, before these muds became compacted into rock. The wurtzite formed first, followed by sphalerite, pyrite and chalcopyrite, and finally by barite or calcite.

SELECTED REFERENCE

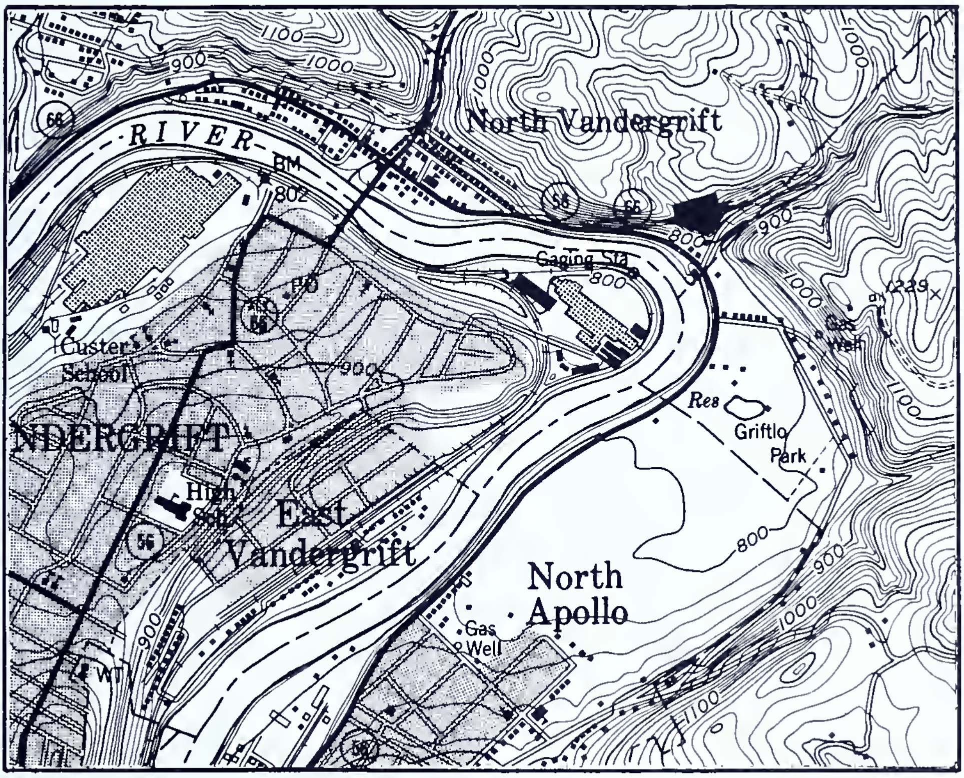
Seaman, David M. and Hamilton, Howard (1950), *Occurrence of polymorphous wurtzite in western Pennsylvania and eastern Ohio,* Am. Min., v. 35, p. 43-50.

ARMSTRONG

NORTH VANDERGRIFT LEAD-ZINC LOCALITY

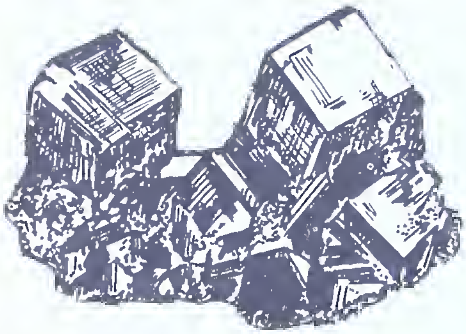
LOCATION

This lead-zinc locality is located near North Vandergrift in the stream bed of Gravel Bar Hollow; just north of the confluence of a small stream with the Kiskiminetas River; in the Vandergrift 7½-minute quadrangle, the north-central rectangle.



MINERALS

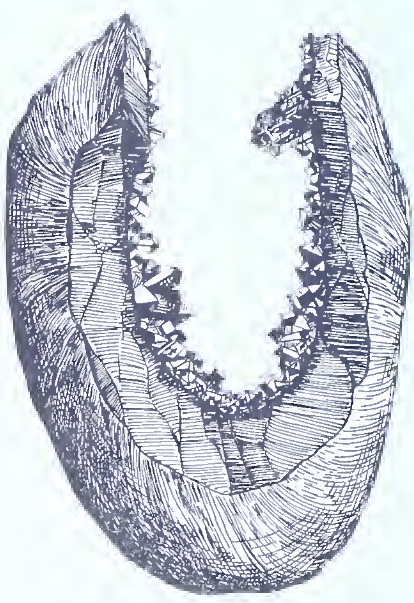
Barite: massive
Calcite: cleavages and occasional crystal rhombs
Galena: massive, crystals uncommon
Sphalerite: massive, cleavages; crystals uncommon



Galena Crystals

GEOLOGY

Nodules of barite containing galena and sphalerite are found in a limy shale at the base of the Upper Freeport coal bed. The nodules probably formed during the deposition of the limy muds on a lake bottom, before they were compacted into a sedimentary rock. Similar sulfide, barite, and manganese nodules are believed to exist along present-day ocean floors.



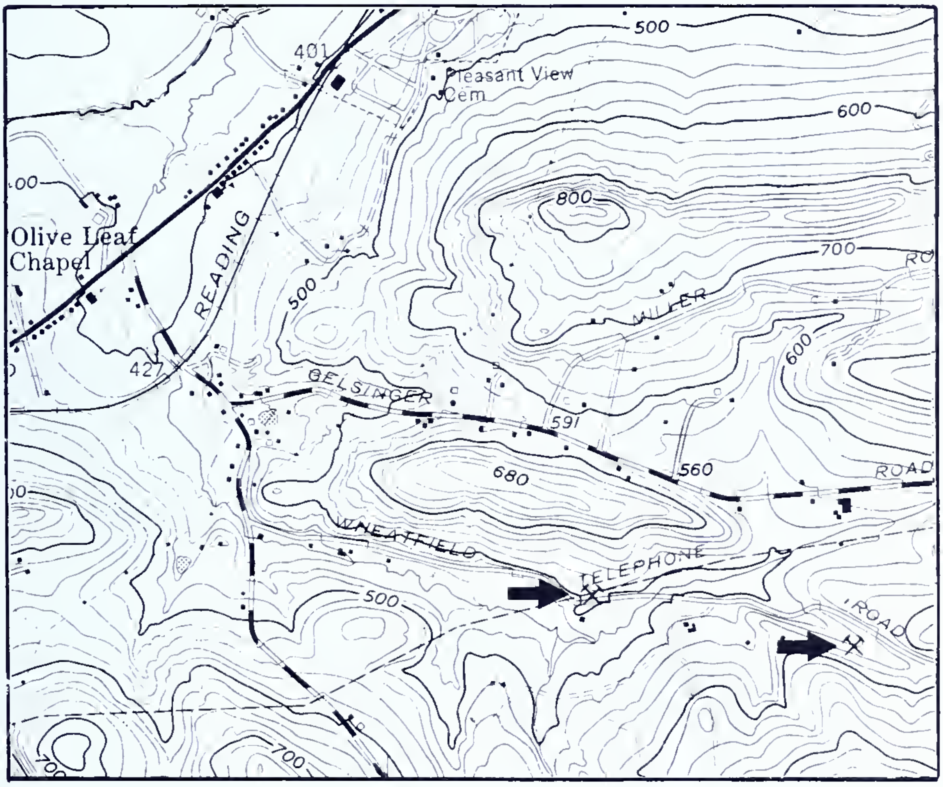
Galena and Sphalerite in Shale Nodule

BERKS

WHEATFIELD MAGNETITE LOCALITY

LOCATION

The Wheatfield iron mine is located in the east-central rectangle of the Sinking Spring 7½-minute quadrangle. Traveling south, take the Fritztown Road from Sinking Spring for two miles, turn left on Chapel Road, proceed for ½ mile, turn left again on Wheatfield Road and proceed on this road for one mile. One of the mines is an open pit next to the town dump along the south side of the road, in Spring Township.



MINERALS

Calcite: small crystals and cleavages; dark green
Chlorite: small crystal flakes

Chlorite-vermiculite: interleaved crystal flakes; brownish-green to light green
Fluorite: rare; amber colored
Garnet: grossular, possibly melanite and andradite
Hematite: rarely in crystal plates
Magnetite: in octahedrons with rare dodecahedral faces
Pyrite: small crystals
Serpentine: massive
Stilbite: rare

GEOLOGY

The iron deposits, and the other associated minerals, occur in limestone. This limestone lies above Triassic diabase, and has been altered (metamorphosed) into a marble by heat emanating from the diabase as it cooled, forming garnet and hematite. In addition hot solutions either from the cooling diabase itself, or traveling upward along the diabase reacted with the limestone, dissolved some of it, and replaced the limestone with serpentine, chlorite, and iron minerals. Chlorite, vermiculite, and the iron minerals are found close to the contact of the diabase and limestone. Melanite (?) garnets are found along fractures within the diabase, while the other garnet varieties are in the limestone, some at quite a distance from the diabase. The mineralization probably took place about 190 million years ago.

SIMILAR OCCURRENCES

Cornwall, Morgantown and French Creek, Pennsylvania

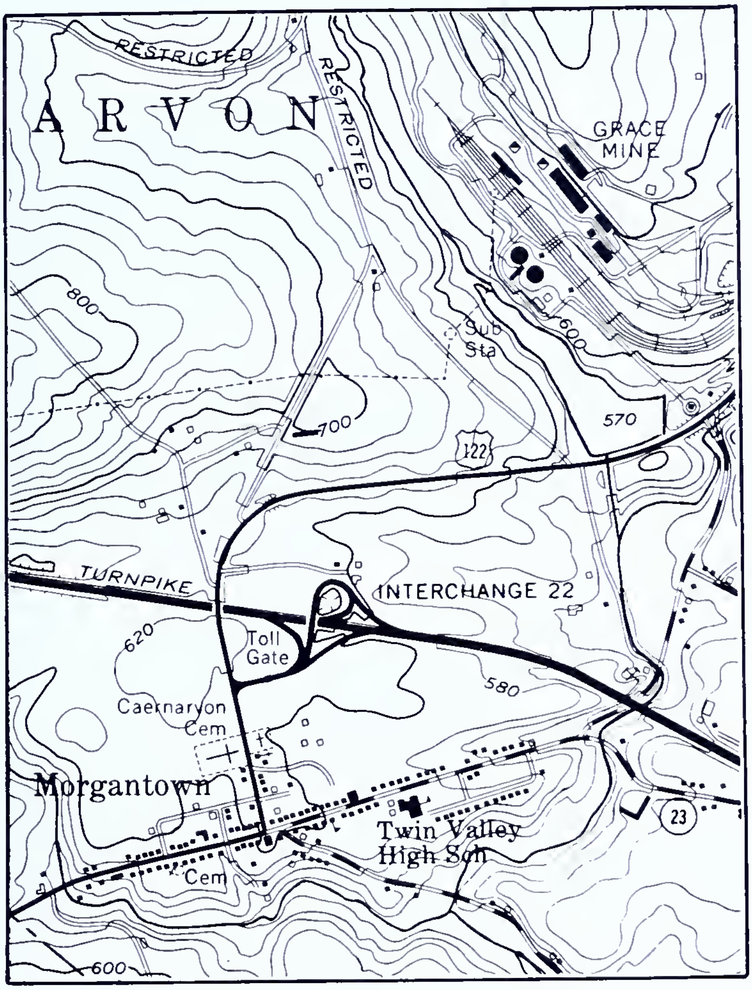
SELECTED REFERENCE

Spencer, Arthur C. (1908), *Magnetite deposits of the Cornwall type,* U. S. Geol. Survey Bull. 359, p. 29-36.

GRACE MINE MAGNETITE LOCALITY

LOCATION

The Grace mine is located in the east-central rectangle of the Morgantown $7\frac{1}{2}$-minute quadrangle. The two head-frames of the mine are located on the topographic map below approximately $1\frac{1}{4}$ miles northeast of the Borough of Morgantown in Caernarvon Township, Berks County. The mine entrance is easily reached by travelling north on state Route 122 immediately upon leaving the Pennsylvania Turnpike Interchange 22 (Morgantown Exit). Permission to collect must be obtained at the mine office.



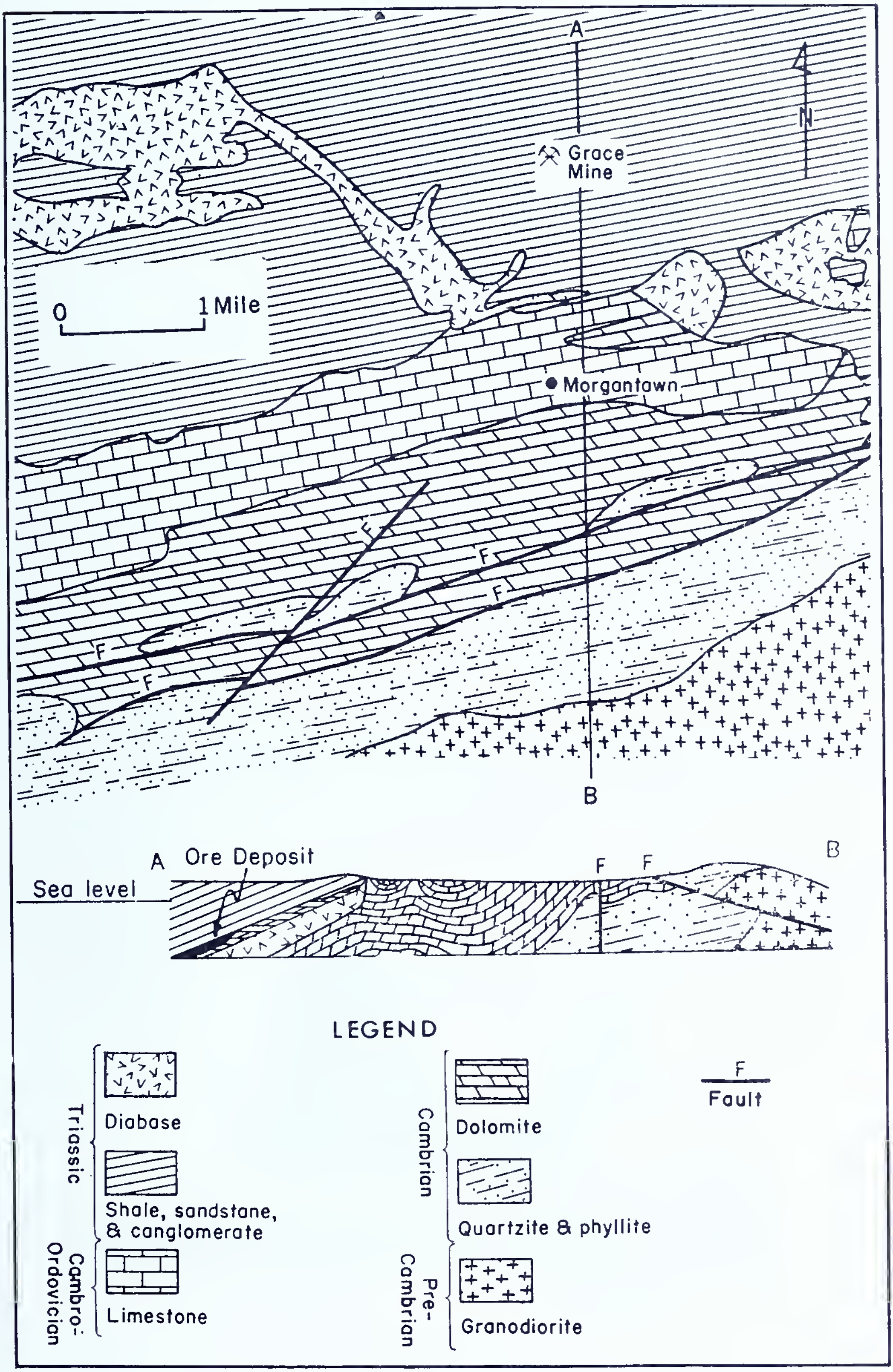
MINERALS

Actinolite: massive needles, byssolite
Antigorite (?) : reported as serpentine
Apophyllite: crystals in vugs associated with zeolites
Calcite: crystals in vugs associated with zeolites
Chalcopyrite: uncommon
Chlorite: green crystals associated with muscovite
Epidote: uncommon; generally massive
Feldspar: commonly pink orthoclase from above the ore zone
Galena: very rare; cleavages and small crystals
Garnet: massive and crystals; probably andradite
Gypsum: selenite cleavages
Hematite: in crystalline plates which may be replaced by magnetite; also variety specularite
Magnetite: massive and small crystals
Muscovite: green crystals associated with chlorite
Natrolite: prismatic needles associated with zeolites
Phlogopite: reported associated with chlorite
Pyrite: crystals
Pyrrhotite: uncommon
Quartz: generally massive
Sphalerite: small crystals; very rare
Stilbite (?) : radial clusters
Tremolite: less common than actinolite; prismatic

GEOLOGY

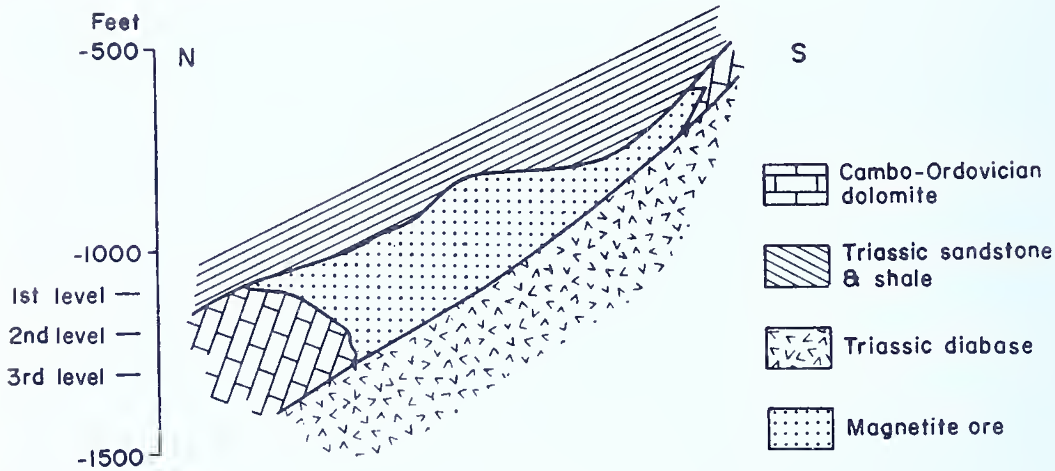
The geology of Bethlehem Steel's Grace mine at Morgantown is essentially the same as their magnetite mine at Cornwall, Lebanon County. Both mines are part of an unusual and extensive magnetite ore province in which the magnetite is always found adjacent to the igneous rock, diabase. Such deposits have been termed pyrometasomatic, meaning relatively high temperatures and a chemical introduction of elements which originated from the same source as the diabase. The ore does not crop out

LOCALITY NOW CLOSED TO COLLECTING



A Generalized Geologic Map and Cross Section of the Morgantown Area, Berks County.

LOCALITY NOW CLOSED TO COLLECTING

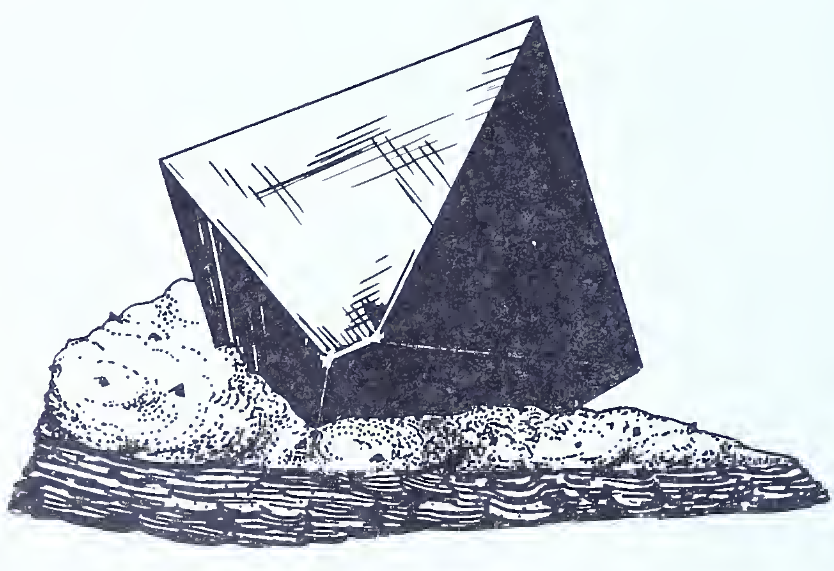


Cross Section of the Grace Mine Ore Body

at the surface, but was discovered by a magnetometer survey which measured the magnetism of the ore body 500 to 2000 feet below the surface.

REFERENCE

Tsusue, Akio (1964), *Mineralogic aspects of the Grace mine magnetite deposit,* Pa. Geol. Survey Bull. M 49, 10 p.



Magnetite Crystal

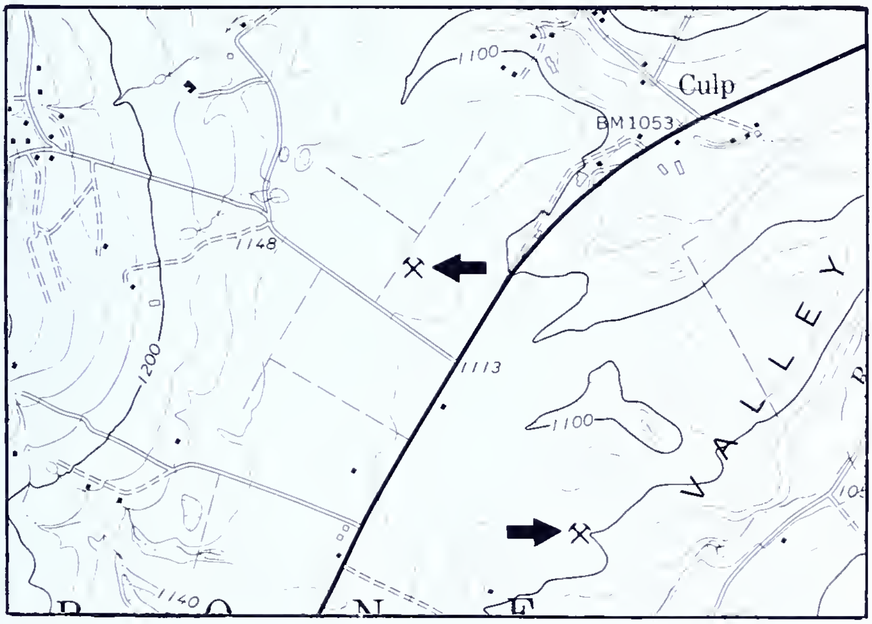
BLAIR

SINKING VALLEY LEAD-ZINC LOCALITY

LOCATION

The lead-zinc mineral localities in Sinking Valley, Blair County, are located in the east-central rectangle of the Bellwood 7½-minute quadrangle and the west-central rectangle of the Tyrone 15-minute quadrangle. The majority of the occurrences are northeast of Altoona, in the vicinity of the village of Culp in Tyrone Township. Small individual abandoned mines and pits are located as follows:

1) Approximately 3,000 feet south of Culp and east of Route 971.
2) Two thousand (2,000) feet southwest of Culp.
3) One mile west of Birmingham in the Tyrone quadrangle.



MINERALS

Anglesite: crystals and massive; crystals uncommon
Barite: massive
Calcite: massive and cleavage rhombs
Cerussite: crystals and massive; crystals uncommon

Dolomite: massive and cleavage rhombs
Fluorite: purple in veins in limestone
Galena: massive cleavages; crystals rare (reported)
Hemimorphite: massive and crystals; often limonite coated
Limonite: coatings and massive
Pyrite: massive and small crystals
Smithsonite: massive and banded
Sphalerite: massive and cleavages

GEOLOGY

All of the above minerals are found associated with limestone. In some cases, the minerals fill fractures within the limestone; in other instances, the limestone has been dissolved by mineral-rich solutions and these new minerals have taken the place of the limestone. The anglesite, cerussite, smithsonite, and hemimorphite all formed by weathering of the galena, sphalerite and dolomite. These minerals, formed by weathering, are closely associated with limonite and are called gossan minerals. Their presence is often an indicator of an ore deposit below the surface. The localization of the minerals is determined by the ease with which the limestone could be dissolved, and by the number of fractures in the limestone. The fractures, in turn, are controlled by the upward bending of the rocks into a fold, called the Sinking Valley anticline. A rock structure such as this is just one of the many geologic factors which control the localization of minerals.

SIMILAR OCCURRENCES

Friedensville zinc deposit in Saucon Valley, Lehigh County; Mississippi Valley lead-zinc ore deposits.

REFERENCES

Butts, Charles, Swartz, F. M. and Willard, Bradford (1939), *Tyrone quadrangle, Pa.*, Pa. Geol. Survey Atlas 96, 116 p.

Reed, Donald F. (1949), *Investigation of the Albright farm lead-zinc deposit, Blair County, Pa.*, U. S. Bureau of Mines Rept. Inv. 4422, p. 1-7.

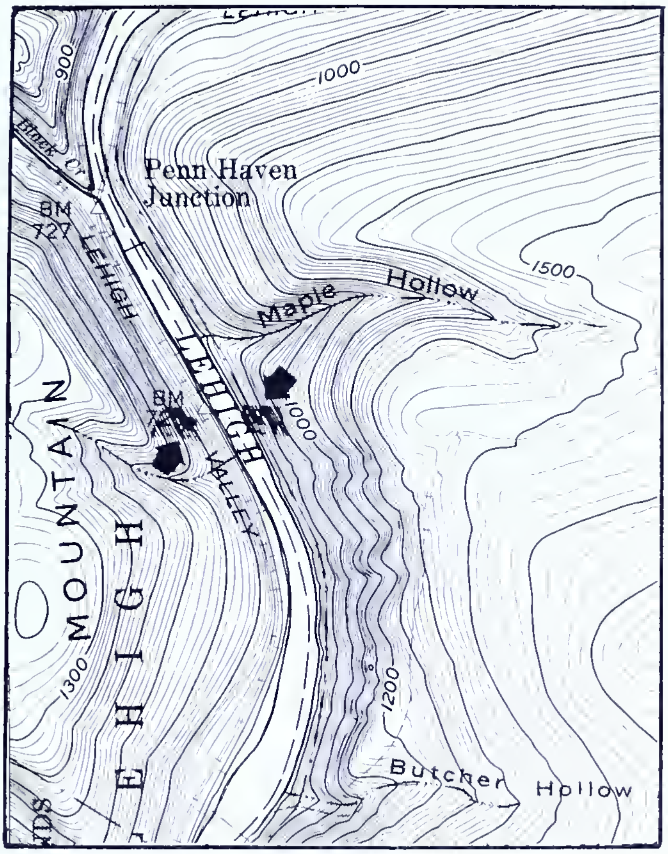
CARBON

URANIUM LOCALITIES

LOCATION

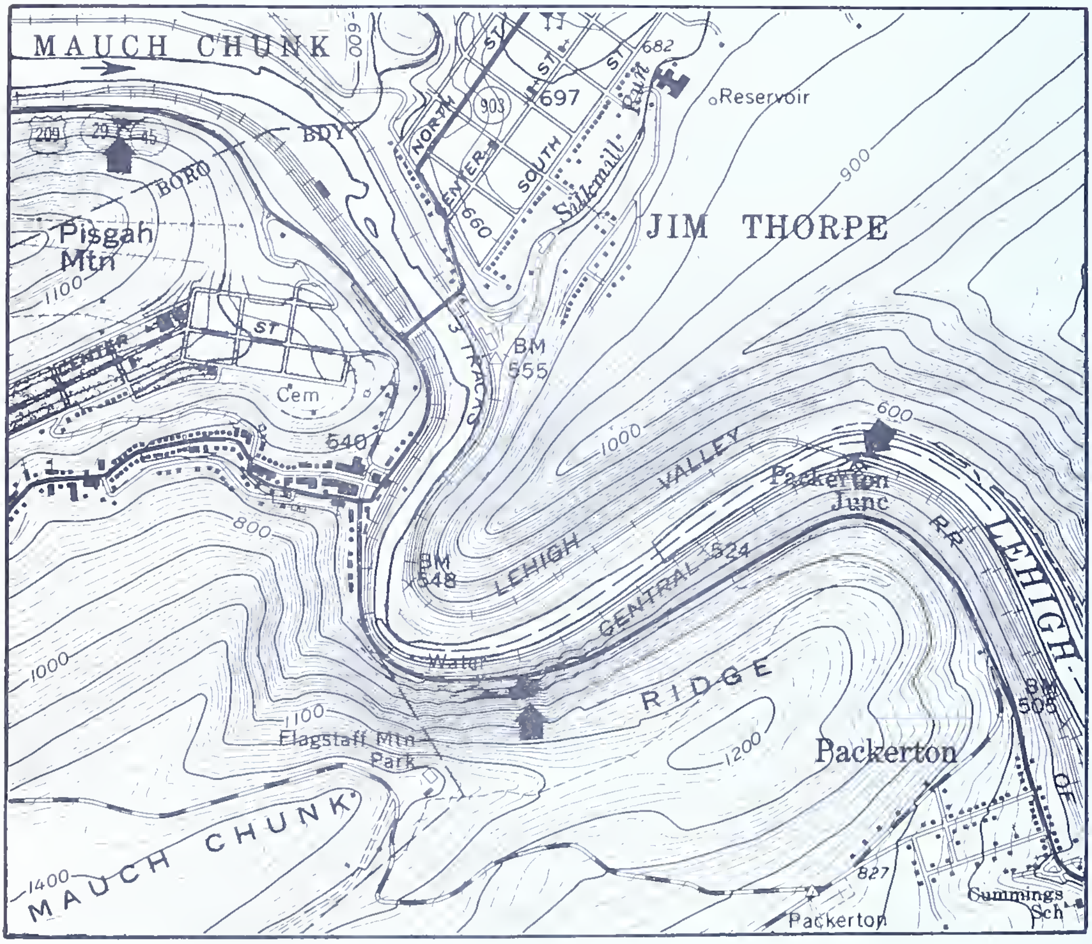
Selected uranium collecting localities in Carbon County are located in the Christmans $7\frac{1}{2}$-minute quadrangle and the Lehighton $7\frac{1}{2}$-minute quadrangle. The areas within these quadrangles that are most promising are as follows:

1) The Penn Haven Junction uranium occurrences are found on the east and west sides of the Lehigh River gorge about 2,000 feet south of Penn Haven Junction.



2) The uranium occurrences on Mauch Chunk Ridge are located about 0.4 mile south of the courthouse in Jim Thorpe (Mauch Chunk) and about three-quarters of a mile along strike to the east side of the railroad bridge that

crosses the Lehigh River about a mile east of Jim Thorpe (Mauch Chunk). This latter occurrence is along the right-of-way of the Central Railroad of New Jersey and on privately owned property. Permission to collect should be obtained.



3) The Mount Pisgah uranium occurrence is on the north side of the nose of Mount Pisgah, near Jim Thorpe (Mauch Chunk), on property owned by the Lehigh Coal and Navigation Co.

MINERALS

Mt. Pisgah:

Allophane: a massive clay mineral; semi-crystalline

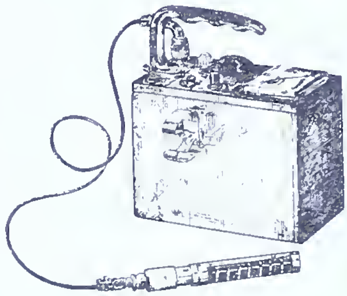
Andersonite: rare
Beta-uranophane: rare
Calcite: in small veins and rock matrix
Carnotite: coating; relatively common
Chlorite: green, in rock matrix
Gypsum: cleavages
Kasolite (?) : needs verification
Liebigite
Opal (?) : needs verification
Quartz: in small veins and rock matrix
Schroeckingerite
Tyuyamunite: coating
Uraninite (?) : associated with carbonaceous material; needs verification
Uranophane: identified by x-ray only

Mauch Chunk Ridge:
Autunite: coating
Carnotite: coating; relatively common
Malachite: staining
Meta-autunite: uncommon; fluorescent
Metatorbernite (?) : uncommon
Meta-uranocircite (?) : tentatively identified by X-ray
Mica: in rock matrix
Uranophane: coating

Penn Haven Junction:
Allanite (?) : disseminated
Carnotite: coating; relatively common
Chlorite: in rock matrix and veinlets
Clausthalite: uncommon; in fine, irregular particles with metallic glint
Hematite: disseminated
Ilmenite: disseminated
Kasolite
Leucoxene: disseminated

Magnetite: disseminated
Mica: in rock matrix
Pyrite: disseminated
Uraninite: associated with carboniferous material; needs verification
Uranophane
Zircon: disseminated

Note: Uranium minerals other than carnotite are difficult to obtain.



GEOLOGY

All of the occurrences listed above have a similar geologic environment and a similar geologic history. They are located on the northern edge of the eastern end of the Appalachian Mountains in Pennsylvania. The sedimentary rocks have been bent (folded) into troughs and ridges (synclines and anticlines, respectively). To the north lies the Pocono Plateau where the beds of sedimentary rocks are nearly horizontal. The uranium and associated minerals are in folded red sandstones or conglomerates of Devonian (Mauch Chunk Ridge; Penn Haven Junction) and Mississippian (Mt. Pisgah) age (300-350 million years old). Within these sedimentary rocks, there are lenses of sandstone which contain carbonaceous material. It is in these lenses that the uranium minerals are found. Similar lenses and channels contain the uranium ores of the Colorado Plateau in the Western United States. Since the Colorado Plateau uranium is thought to be localized in old, buried stream channels, the same origin is inferred for these Carbon County occurrences.

SIMILAR OCCURRENCES

In Bradford, Sullivan, Lycoming, Columbia, and Wyoming Counties in the Catskill Formation; the Colorado Plateau in the western part of the United States.

REFERENCES

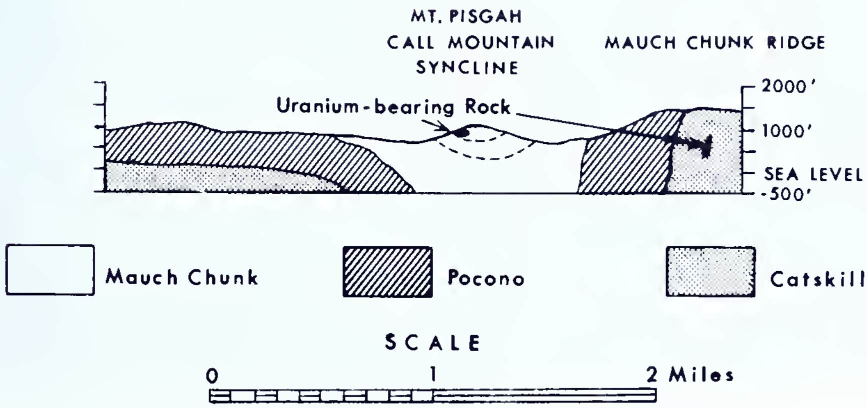
Dyson, James L. (1955), *Relation of stratigraphy and structure to uranium occurrences near Mauch Chunk, Pennsylvania,* Pa. Geol. Survey, Inf. Circ. 5, p. 124-134.

McCauley, John F. (1957), *Preliminary report on the sedimentary uranium occurrences in Pa.,* Pa. Geol. Survey Prog. Rept. 152, p. 1-22.

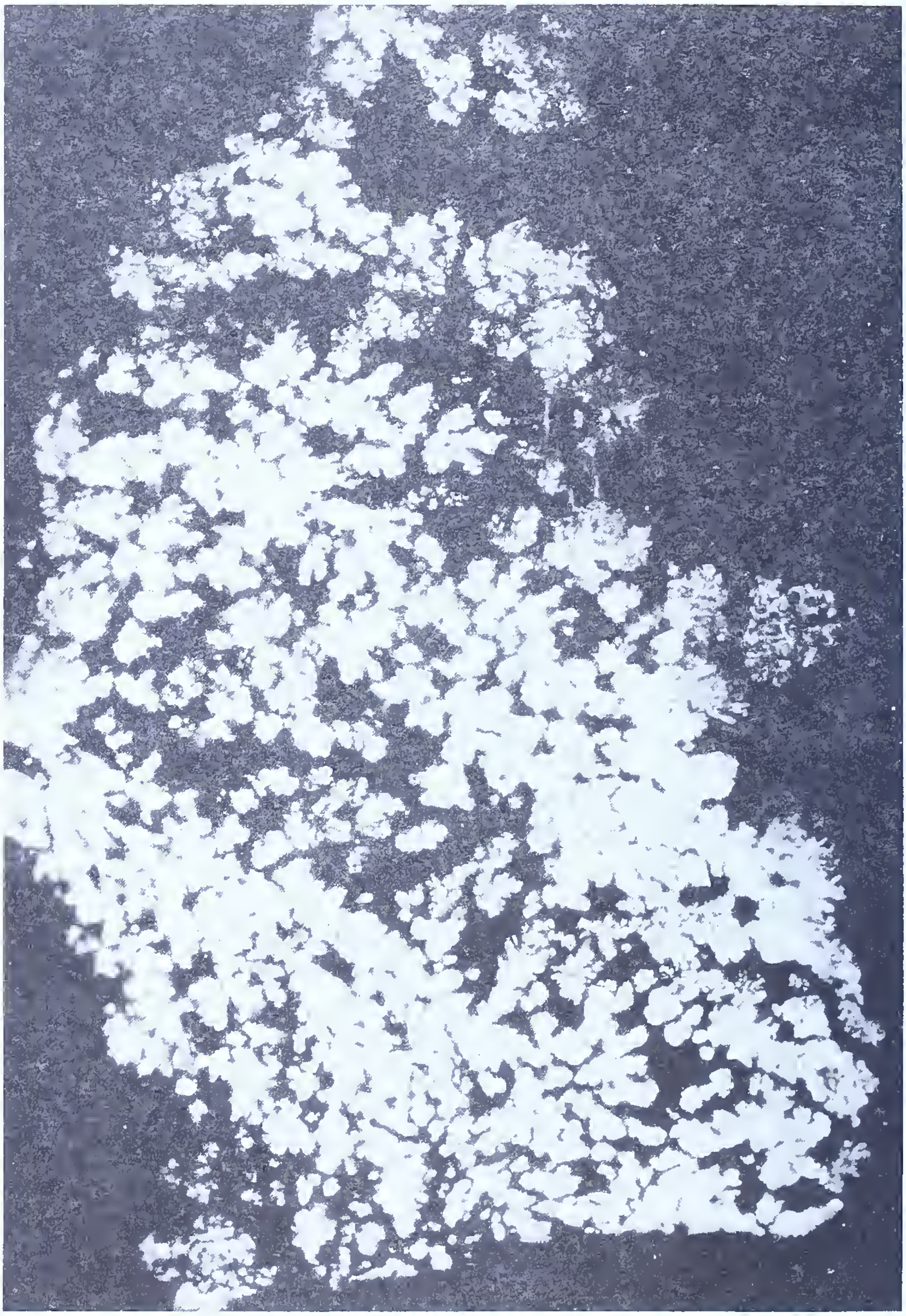
——— (1961), *Uranium in Pennsylvania,* Pa. Geol. Survey Bulletin M 43, 75 p.

Montgomery, Arthur (1954), *Uranium minerals of the Mauch Chunk area, Pennsylvania,* Pa. Acad. Sci., v. 28, p. 102-110.

Klemic, Harry and others (1963), *Geology and uranium occurrences of the northern half of the Lehighton, Pennsylvania, quadrangle and adjoining areas,* U. S. Geol. Survey Bull. 1138, p. 1-97.



Geologic Cross Section at Mt. Pisgah

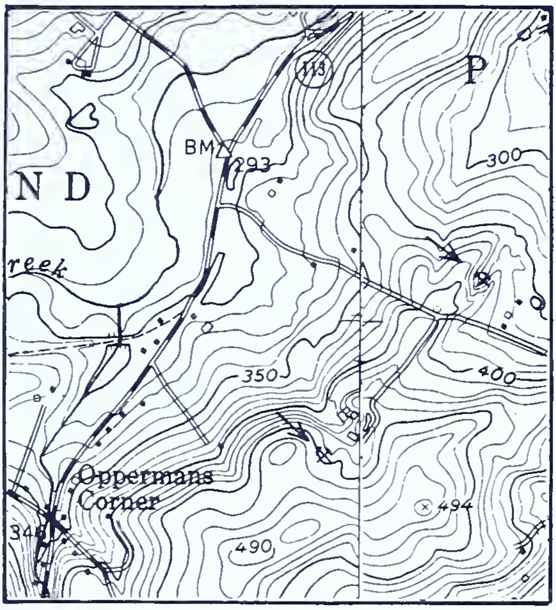


Autoradiograph of Uraninite

CHESTER

GRAPHITE LOCALITY

LOCATION



The graphite quarries, at one time operated by the Graphite Corporation of America and also the site of the old Ben Franklin Mine, are located about one-half mile northeast of the village of Oppermans Corner on Route 113. These quarries are in West Pikeland Township which is located in the east-central rectangle of the Downingtown 7½-minute quadrangle and the west-central rectangle of the adjoining Malvern 7½-minute quadrangle. This locality may easily be reached by persons travelling the Pennsylvania Turnpike. Exit at Interchange #23 (Downingtown) and proceed south on Route 100 for approximately one-half mile to Route 113 and then proceed north. The graphite quarries are about 2.3 miles northeast of Interchange #23.

MINERALS

Biotite: flakes in schist
Feldspar: grains in schist
Garnet: small crystals
Graphite: foliated, massive and flaky
Hornblende: reported in nearby gneiss
Limonite: coatings
Pyrite: small cubes weathering to limonite
Quartz: white and blue; massive
Zircon: small crystals in schist; uncommon

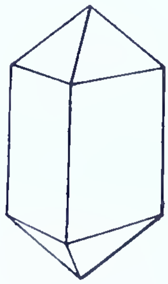
GEOLOGY

The graphite occurs in several different geological associations. The majority is present as foliae and flakes in a rather compact quartz-mica schist. This schist is a metamorphic rock, which means that heat and pressure have been applied to a sedimentary rock, such as shale. The application of this heat and pressure has resulted in the alignment of mineral grains along parallel planes. This parallel arrangement is called schistosity. Graphite is one of the minerals which is aligned along these schistosity planes. Graphite is also abundant in quartz veins, and may result in concentrations of a high grade. Two less important modes of occurrence are as graphite flakes along cleavage planes of feldspar and along schistosity planes in a biotite-hornblende-feldspar rock. The graphite concentration owes its origin, at least in part, to the metamorphism which altered some previous sedimentary rock rich in carbonaceous material.

SELECTED REFERENCES

Miller, B. L. (1912), *Graphite deposits of Pennsylvania,* Pa. Geol. Survey, 3rd. ser., Econ. Rept. #6, p. 67-82, 96-110.

Sanford, R. S. and Lamb, F. D. (1949), *Investigation of the Benjamin Franklin graphite mine (government owned) and the Just graphite mine, Chester County, Pa.,* U. S. Bureau of Mines Rept. Inv. 4530, 17 p.

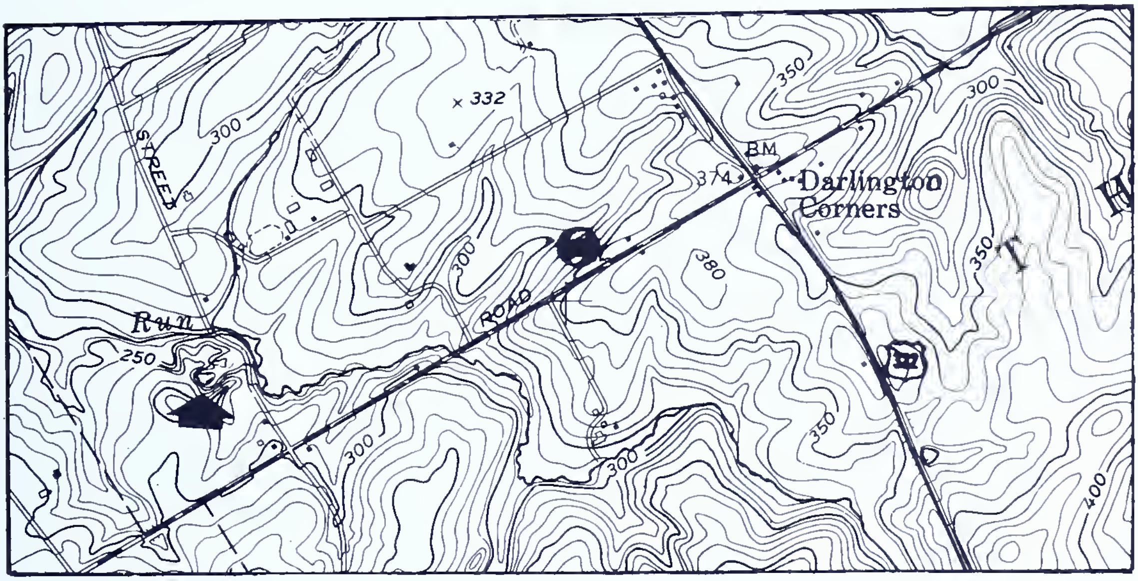


Zircon Crystal

BRINTON QUARRY VERMICULITE LOCALITY

LOCATION

The Brinton quarry is located just north of Route 926 and west of Route 322 at the community of Darlington Corners, 1.4 miles south of West Chester. On the West Chester 7½-minute topographic map, it is located in the northern half of the southwest rectangle.



This locality is a private club and permission to enter must be obtained.

MINERALS

Actinolite: compact crystal needles
Amphibole: asbestos
Antigorite: massive serpentinite; also "williamsite" type and "picrolite"
Aragonite: along fractures
Beryl: rare; in pegmatites
Brucite: crystalline plates; uncommonly in rosettes
Calcite (?): rosettes reported
Chromite: uncommon; in massive serpentinite

Chrysotile: fibrous, cross-fiber serpentine veinlets in massive serpentinite
Clinochlore: green chlorite crystals; also interleaved with vermiculite; chromiferous variety rare
Colerainite: small crystals; clusters; rare
Deweylite: tan to reddish brown
Enstatite, var. Bronzite: uncommon; within massive serpentinite
Feldspar: massive oligoclase cleavages, crystals rare
Hematite: small crystal plates
Hydromagnesite: powdery coating and rare small crystals
Limonite: pseudomorphs after pyrite at serpentinite–pegmatite contact
Magnesite: massive
Magnetite: grains in serpentinite, nodules in soil
Muscovite: uncommon; in pegmatites
Olivine: within serpentinite
Quartz: drusy and massive on fractures
Sepiolite (?) : a questionable weathering product
Talc: massive and small flakes
Tourmaline: schorl; rare; in pegmatites
Tremolite: associated with actinolite; uncommon
Vermiculite: brown crystal prisms; at serpentinite–pegmatite contacts; "jefferisite"

GEOLOGY

Based on their geologic occurrence, the above minerals may be divided into two groups. The first group contains minerals irregularly distributed throughout the serpentinite rock. These include various serpentine-group minerals as well as bronzite, olivine, chromite, and magnetite. The majority of collectable minerals belong in the second group: minerals which are concentrated along fractures in the serpentinite. The most common fillings contain tremolite-actinolite on the outer edge with chlorite, talc, and vermiculite crystals toward the center; rarely feldspar or tourmaline are present in the center of the pegmatite. Pyrite altered to limonite is present in serpentinite at the pegmatite contacts. These zoned minerals at the pegmatite contacts are the result of a chemical reaction between the silica-rich, heated solutions which formed the quartz-feldspar dikes, and the minerals already present in the serpentinite. Weathering has resulted in a host of secondary minerals such as hydromagnesite and deweylite.

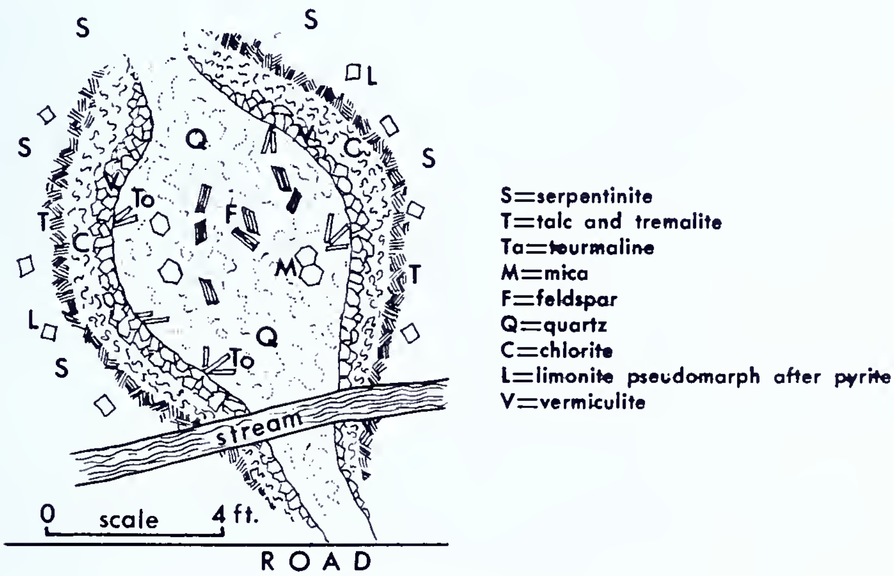
SIMILAR OCCURRENCES

Cedar Hill quarry; Wood mine; the Line Pit; Low's Pit (see "Lancaster County, Chromite Locality") ; Greenville, South Carolina; Libby, Montana.

SELECTED REFERENCES

Gordon, Samuel G. (1922) , *The mineralogy of Pennsylvania,* Phila. Academy of Natural Sciences, Spec. Pub. #1, p. 182-183.

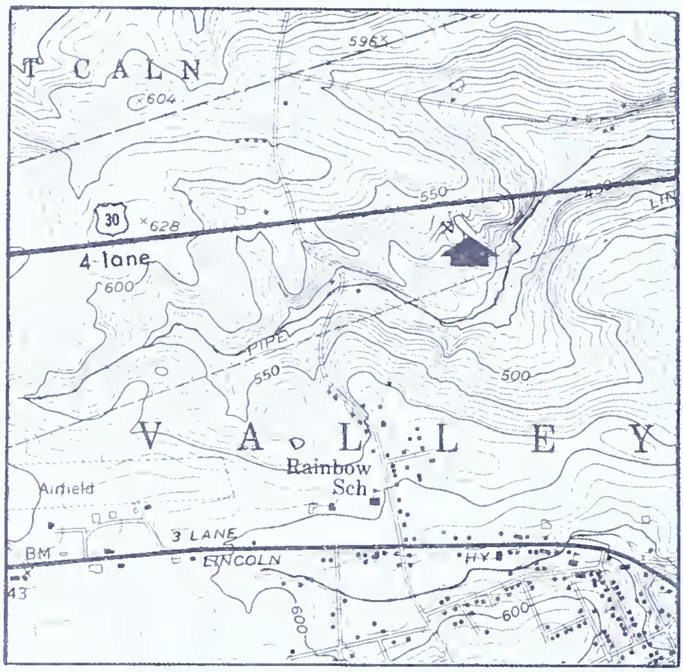
Larsen, Esper S. (1928) , *A hydrothermal origin of corundum and albitite bodies,* Econ. Geol., v. 23, p. 398-433.



Diagramatic Sketch of Pegmatite

COATESVILLE PEGMATITE LOCALITY

LOCATION



The quarry shown in the above map is located approximately 1.5 miles northwest of Coatesville and is one of three known pegmatite excavations in this general area. This quarry was on the Boyle Estate in 1931 and was opened originally about 1916. New Route 30 by-pass around Coatesville passes this locality. Collectors are urged to park along the side road and walk to the site; parking is not permitted along Route 30 by-pass. The quarry location is easily spotted in the northwest rectangle of the Coatesville 7½-minute quadrangle.

MINERALS

Beryl: small yellow to green crystals in pegmatite
Biotite: in 2″ to 6″ books in pegmatite
Chlorite: in schist and gneiss wall rock around pegmatite
Dumortierite: reported occurrence
Epidote: small, light green crystals in pegmatite; rare
Garnet: in wall rock schist at pegmatite borders

Kaolinite: massive, also as pseudomorphs; altered from feldspar; uncommon
Microline: in graphic intergrowth with quartz in pegmatite
Muscovite: crystal plates in pegmatite; also as pseudomorphs
Pyrrhotite: in quartz gneiss southeast of pegmatite; massive
Quartz: (amythyst reported) in graphic intergrowth with microcline; also smoky
Rutile (?) : reported near pegmatite-schist contact
Tourmaline: variety schorl; stubby crystals in microline-quartz pegmatite; uncommon
Vermiculite: brown plates altered from biotite

Unusual Minerals

Graphic granite suitable for decorative stone in small quantities; kaolinite and muscovite pseudomorphs after beryl, tourmaline, garnet and epidote along east quarry wall

GEOLOGY

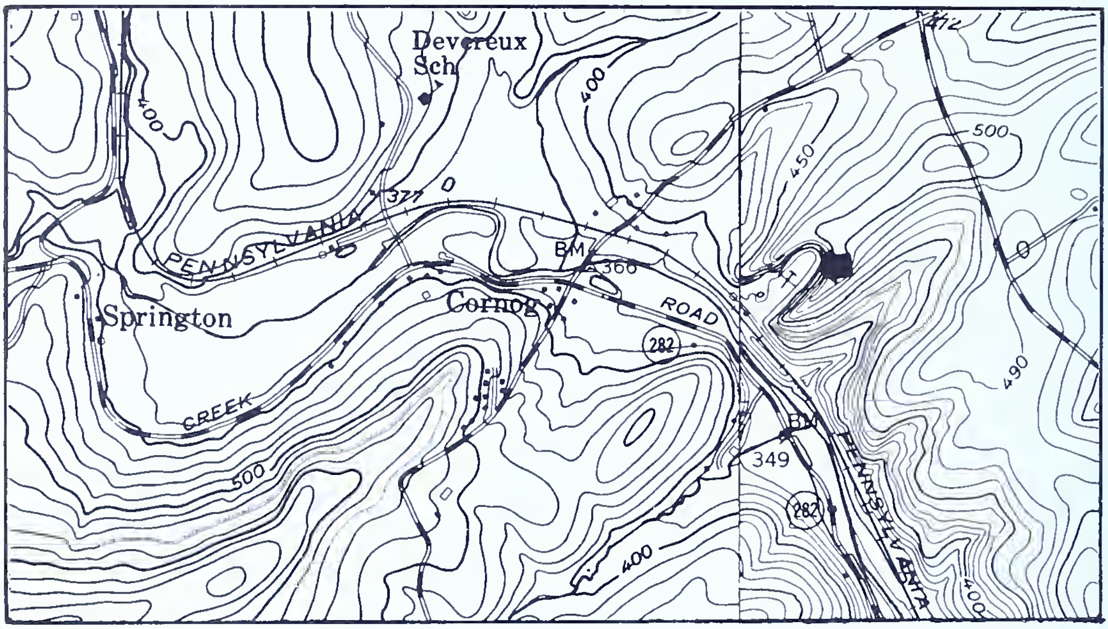
This area north and west of Coatesville contains several intrusive pegmatite dikes which have been quarried in the past for feldspar. The pegmatites have intruded a banded igneous rock of highly variable texture and composition. It is generally referred to as a gabbroic gneiss possibly of Precambrian age. While this gneiss may in part be an igneous rock, it has also been metamorphosed. The pegmatite is pod-shaped and the minerals only crudely zoned. The central core contains feldspar and quartz largely altered to kaolinite. Beryl is closely associated with muscovite and quartz veinlets, both of which are younger than the tourmaline and feldspar. Muscovite pockets in feldspar are also common. Biotite, vermiculite, garnet, and chlorite formed at the pegmatite-gneiss contact. Late veins of massive quartz are also present. Nearby, in the gneiss, massive pyrrhotite and quartz are interlayered. The minerals in the pegmatite are probably unrelated to pyrrhotite formation.

REFERENCE

Stone and Hughes (1931), *Feldspar in Pennsylvania,* Pa. Geol. Survey Bull. M 13, p. 51-55.

CORNOG BLUE QUARTZ LOCALITY

LOCATION



The Keystone Trap Rock Company quarry at Cornog is located in the west-central rectangle of the Downingtown 7½-minute quadrangle. The quarry may be reached by traveling north from Downingtown on Route 282, via the village of Lyndell, and turning right (northeast) at the cross-roads in Cornog. The quarry is not now active and permission to enter must be obtained at the office.

MINERALS

Actinolite: compact crystal blades in gneiss; rarely single crystals; also byssolite in large tufts in vugs

Albite: in small white crystals usually in vugs with orthoclase

Allanite: small, massive crystals; radioactive

Ancylite: small, pale pink crystals; with calcite and actinolite

Andesine: in amphibolite rock

Apatite: in translucent, nearly colorless crystals in vugs with tourmaline and byssolite
Apophyllite: small, white crystals, often etched
Axinite: dark brown to greenish brown crystals
Barite: massive (?)
Biotite: in amphibolite rock
Calcite: cleavages and small crystals
Chalcopyrite: massive and grains
Chlorite: small flakes in gneiss
Clinozoisite: large crystal prisms rarely terminated; in quartz veins up to 6″ in length; may be epidote in part
Copper: native; rare
Epidote: reported in amphibolite and vugs
Feldspar: var. orthoclase, rarely in crystals
Galena: rare
Garnet: small crystals in gneiss
Goethite: pseudomorphs after pyrite with limonite
Greenockite: reported
Gypsum: massive, uncommon
Hemimorphite: white to gray crystal aggregates
Hornblende: in gneiss as black blades
Malachite: reported
Muscovite: in amphibolite rock
Prehnite: small crystal groups in quartz vein with clinozoisite, pyrite, and actinolite
Pyrite: very small crystals
Pyrrhotite: rare
Quartz: blue variety probably caused by small, needle inclusions; rarely occurs with parallel growth crystal faces of rhombic habit; also clear and smoky; in vugs in large crystals; triboluminescent
Sphalerite: uncommon; dark brown with byssolite
Sphene: reported in gneiss
Tourmaline: small crystals of schorl and dravite; rare

Vanadinite: small flesh to yellow colored crystals in tufts on actinolite and feldspar crystals
Zircon: in amphibolite rock
Zoisite (?): probably confused with clinozoisite

GEOLOGY

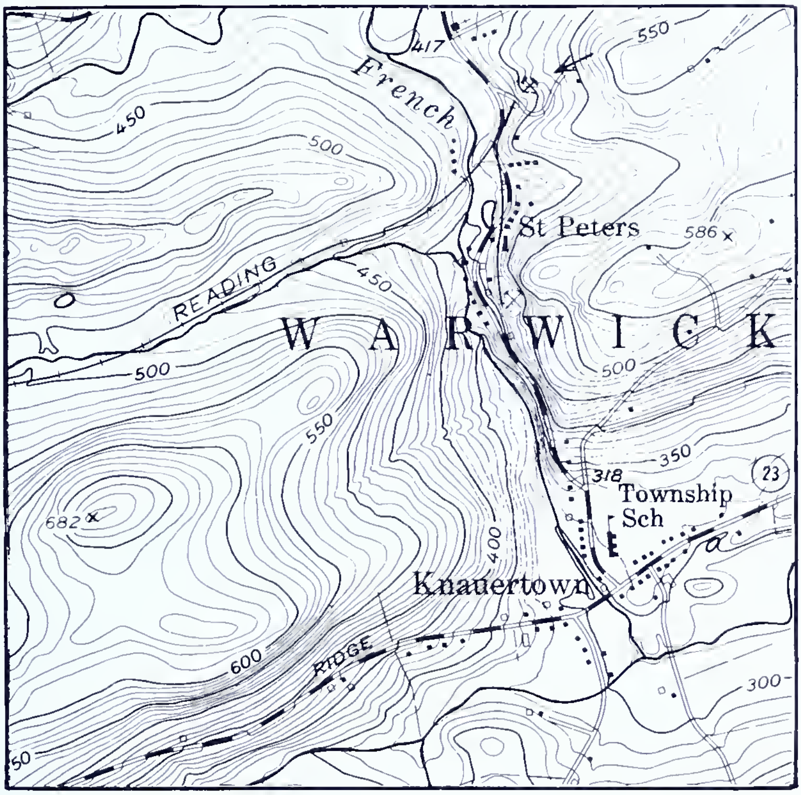
The blue quartz occurs as lenses and stringers in a banded hornblende-quartz-garnet rock. The rock is a hornblende gneiss, which is a metamorphic rock formed by heat and pressure applied to a previous sedimentary rock of possibly Precambrian age. A gneiss such as this has a banding, or layered texture, which is similar to that of a schist, except that the banding is generally one of alternating light- and dark-colored minerals, and is more compact than in a schist. The origin of the quartz is, at least in part, a result of the heat and pressure applied during metamorphism. The blue color in the quartz is caused by small needle-shaped inclusions within the quartz. Pegmatites of intrusive igneous origin cut the gneiss parallel to its bands and contain quartz, clinozoisite, and tourmaline. Small, dense dikes of uncertain composition also cut the gneiss and contain the sulfide minerals.

REFERENCES

Bascom, F. and Stose, G. W. (1932), *Coatesville-West Chester, Pa.-Del.,* U. S. Geol. Survey Folio 223.

FRENCH CREEK MAGNETITE LOCALITY

LOCATION



The French Creek mine and dumps are located in Warwick Township approximately 3/4 mile north of Knauertown on Route 23 and approximately 1/8 mile north of the village of St. Peters. This location may be found in the west-central rectangle of the Pottstown 7 1/2-minute quadrangle. The mine and dumps are privately owned and permission to collect must be secured.

The Jones mine to the west (see references) also contains dolomite, aurichalcite, malachite, actinolite, magnetite, aragonite, limonite, apatite, chalcopyrite, and muscovite.

MINERALS

Common

Actinolite: fibrous byssolite; also needle inclusions in calcite

Anthophyllite: fibrous

Aragonite: small crystals
Azurite: generally as a coating
Biotite
Calcite: white, green to nearly black crystals and cleavages, sometimes pinkish from oxidized iron
Chalcopyrite: crystal tetrahedrons up to ½ inch (uncommon)
Chlorite: crystal flakes
Covellite and Bornite: coatings associated with chalcopyrite
Epidote: massive; rarely crystalline
Feldspar: orthoclase generally as cleavages
Garnet: andradite and grossular crystals; small
Hematite: plates, frequently in calcite
Hornblende: black blades
Ilmenite: black with good cleavage, in diabase
Magnetite: platy, octahedral crystals, massive
Malachite: coatings associated with chalcopyrite
Pyrite: octahedral crystals and cubes
Quartz: massive and occasional small crystals
Talc: flaky to massive
Tremolite: white "hairs" on calcite; similar to byssolite

Rare

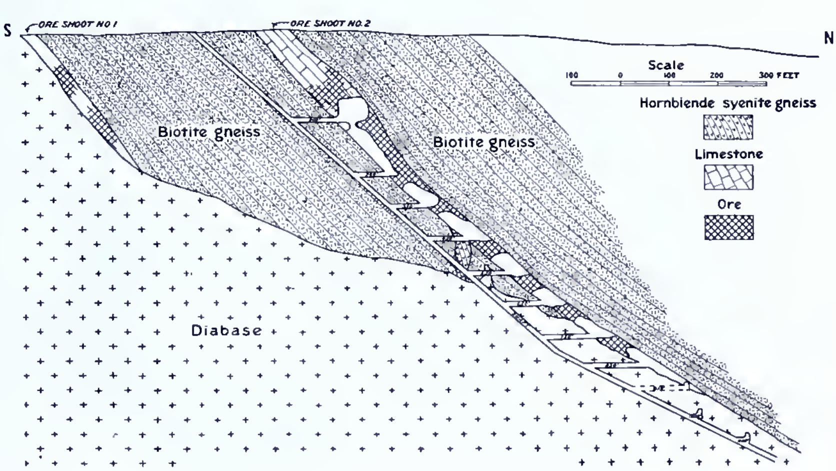
Ankerite: reported but doubtful; may be magnesite
Apatite: small crystals in limestone, blue or green
Apophyllite: good crystals now scarce
Augite: associated with hornblende
Chalcodite: not reported in recent years
Chrysocolla: probably a hydrous copper silicate mixture
Epidote: crystals
Erythrite: coatings
Graphite: flakes
Gypsum: cleavages and single crystal groups
Heulandite: crystals
Pyrrhotite: usually massive
Rhodochrosite: may be manganocalcite

Siderite: reported
Sphalerite: small ruby-colored crystals
Stilbite: crystal sheaves
Stilpnomelane: small brown flakes in cavities with byssolite and feldspar
Tourmaline: schorl
Wernerite: not reported recently
Zoisite: needs verification; may be clinozoisite

Most Interesting Available Minerals
- Byssolite needles in limestone vugs
- Chalcopyrite tetrahedrons in calcite
- Green calcite with byssolite inclusions
- Grossular garnet
- Heulandite crystals
- Platy magnetite and magnetite octahedrons

GEOLOGY

The magnetite and associated minerals occur in limestone. They have replaced the limestone by dissolving it, with the crystallization of other minerals in its place. The ore and sulfide minerals are found both as massive lenses or pods and scattered throughout the limestone. The other minerals which are not potential ores are termed gangue (or accessory) minerals.



Geologic Cross Section of West End of French Creek Mine.

These are generally on the fringes of the massive ore and continue for quite a distance away from the ore, into the limestone. This mineralization of the limestone occurred next to an intrusive igneous rock, diabase, which has cut through limestone. For this reason, the origin of the ore and other minerals is believed to be related to the diabase. For a further discussion of similar deposits, see the Cornwall and Morgantown localities and geological descriptions.

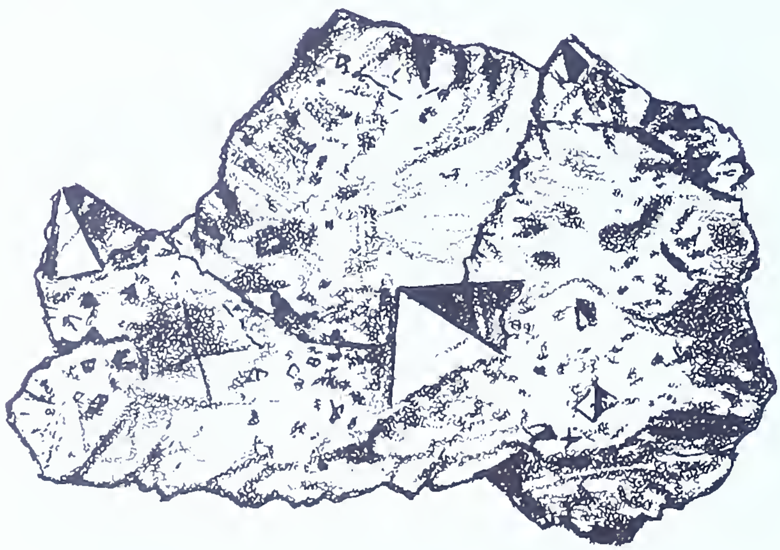
SIMILAR OCCURRENCES

Warwick, Hopewell, and Jones mines in this vicinity; also Cornwall in Lebanon County, Morgantown in Berks County and the Wheatfield iron mines in Berks County.

REFERENCES

Bascom, F. and Stose, G. W. (1938), *Geology and mineral deposits of the Honeybrook and Phoenixville quadrangles, Pa.*, U. S. Geol. Survey Bull. 891.

Smith, Laurence L. (1931), *Magnetite deposits of French Creek, Pennsylvania*, Pa. Geol. Survey, 4th series, Bull. M 14, p. 1-52.



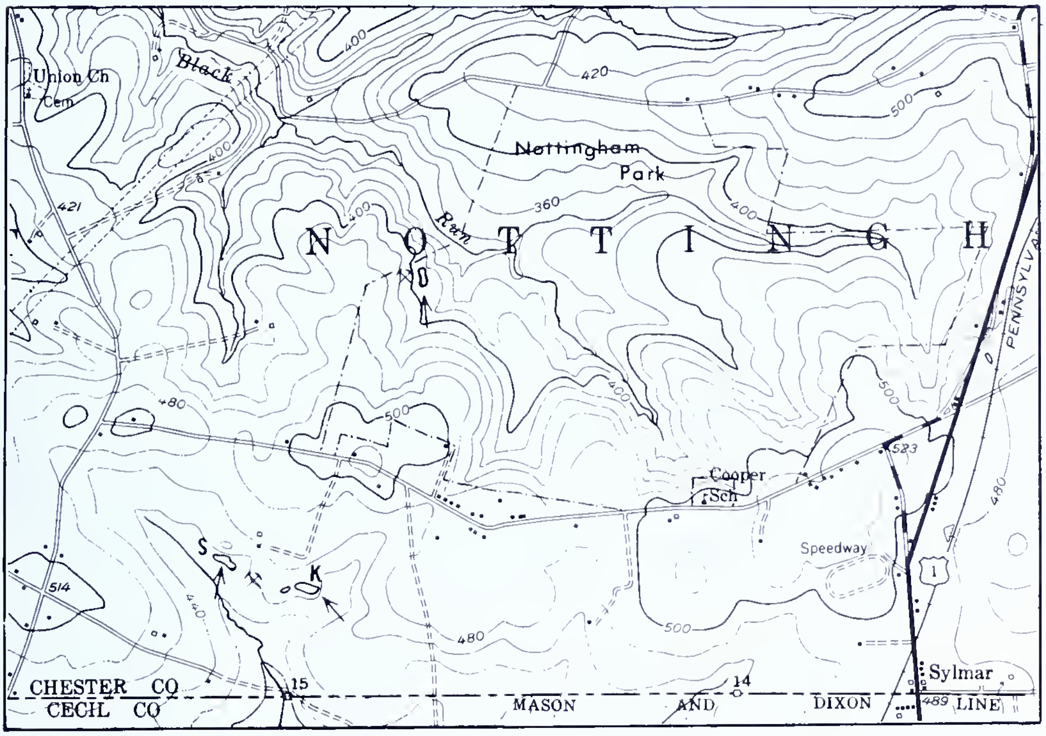
Octahedral Crystals of Pyrite

STATE LINE DISTRICT

FELDSPAR LOCALITIES

LOCATION

The Sparvetta and Keystone quarries are located in the north-central rectangle of the Rising Sun 7½-minute quadrangle, approximately 1¼ miles southwest of Nottingham in West Nottingham Township.



The quarries are now abandoned and filled with water. They appear as small lakes on the above map. The Sparvetta (S) and Keystone (K) quarries are located to the south of the east-west road shown on the above map. Collecting is excellent from the large mine dumps adjacent to these quarries and around the quarry north of the east-west road. This latter quarry is located in Chester County's Nottingham Park.

MINERALS

Actinolite: compact fibers

Albite: cleavages with rare moonstone
Amphibole: var. asbestos
Antigorite: the majority of the massive serpentinite; also "williamsite"; chromiferous, pink fibers from Chester County, Nottingham Twp., Park
Apatite: crystals uncommon
Aragonite: small crystals fluoresce white to pink
Chlorite: in flakes, probably clinochlore
Chlorite-vermiculite: flakes which are interlayered brownish green to brown
Chromite: grains in serpentinite; veins and massive from Chester County, Nottingham Twp., Park
Chrysotile: fibers in small veinlets
Colerainite: rare, crystal rosettes on feldspar
Deweylite: tan, brown, gray; waxy and brittle
Dolomite: tan colored; fluorescent
Goethite: reniform in surrounding fields up to 6-8″ masses, especially in fields north of Cooper School
Hematite: massive and secondary coatings
Kämmererite: pink to rose-violet chlorite on chromite, Chester County Park area
Magnetite: small octahedrons in serpentinite and chlorite schist
Molybdenite: very rare; needs verification
Muscovite: crystal flakes associated with pegmatite
Orthoclase: massive, rarely in crystals
Quartz: usually massive with feldspar
Talc: usually massive near pegmatite-serpentinite contact
Tourmaline: very rare; schorl
Zoisite: needs verification; may be clinozoisite

Interesting Minerals

Colerainite crystal rosettes; a rare mineral but not too uncommon here
Feldspar: translucent albite

Goethite: large masses in nearby fields, especially north of Cooper School
Dolomite: fluorescent, tan-colored
Chrome-antigorite: pink to rose-violet fibers on chromite from Chester County Park area

GEOLOGY

The majority of the above minerals occur in a coarse-textured quartz and feldspar rock which is called a pegmatite. In general, the coarser the grain size of this pegmatite, the larger are the crystals of the accessory minerals, such as tourmaline and muscovite. The distribution of minerals other than quartz and feldspar, the accessory minerals as these minor constituents are called, is often quite irregular. The pegmatite which contains these minerals formed by cooling and crystallization from hot solutions. These solutions flowed through fractures in a dark serpentinite rock which is the major rock type in this area. Minerals such as antigorite, chrysotile, chromite, chlorite, and talc are related to the serpentinite and crystallized earlier than the pegmatite minerals. Others, such as aragonite, colerainite, and deweylite were the last minerals to form as a result of deposition during weathering.

REFERENCES

Bastin, E. S. (1910), *Feldspar deposits of the United States,* U. S. Geol. Survey Bull. 420, p. 63-72.

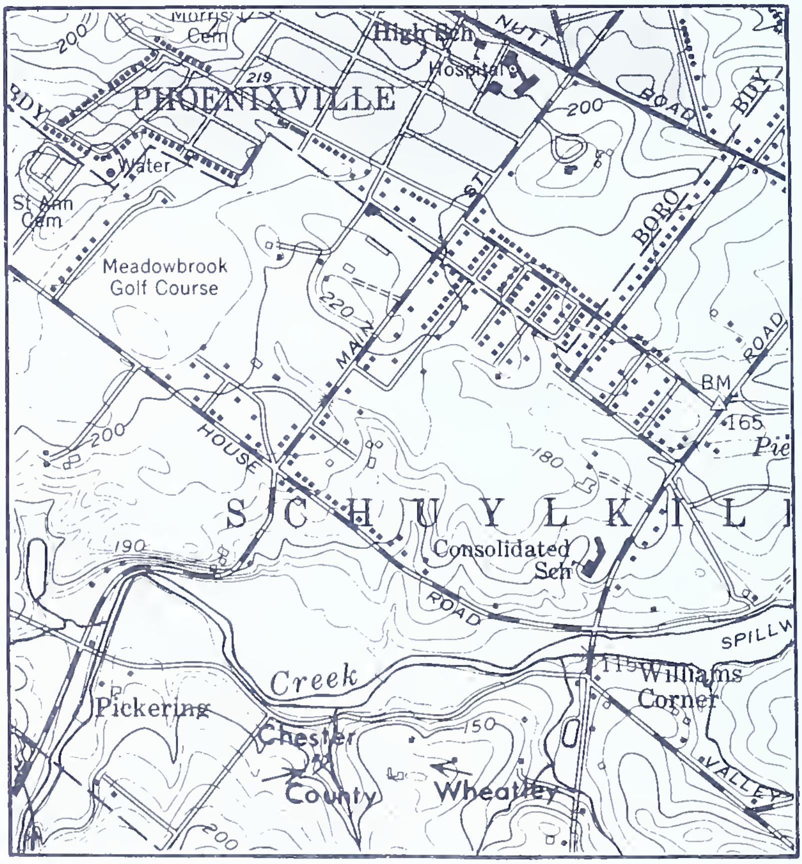
Stone, R. W. and Hughes, H. H. (1931), *Feldspar in Pennsylvania,* Pa. Geol. Survey, 4th Series, Bull. M 13, 63 p.

Watts, A. S. (1916), *The feldspars of the New England and North Appalachian states,* U. S. Bureau of Mines Bull. 92, p. 145-158.

WHEATLEY AND CHESTER COUNTY MINES
PHOENIXVILLE LEAD-ZINC LOCALITIES

LOCATION

The Wheatley mine and the Chester County mine are located in the northeast rectangle of the Malvern 7½-minute quadrangle. The mines are about 0.2 mile south of the road between the villages of Pickering and Williams Corner. The mine dumps may be reached by turning right (south) at the first dirt road east of the village of Pickering, and proceeding south about 0.15 mile to a small white building on the left (east). This building and property belong to a private hunting and shooting club. Permission to enter must be obtained from the club because of safety reasons. Proceed along a path south of the hunting club building about 300 feet, and then walk south, uphill, to the dumps.



MINERALS

Anglesite: occasional crystals; massive
Aragonite: tufted crystals
Barite: massive
Bornite: coating associated with chalcocite, chalcopyrite
Calcite: scalenohedral crystals: cleavages
Chalcopyrite: crystal tetrahedrons rare; massive
Chlorite: crystal flakes
Dolomite: cleavage rhombs
Enstatite: bladed in gneiss
Galena: massive cleavages; crystals very rare
Goethite: with limonite
Hematite: specular (micaceous)
Hemimorphite: crystals associated with anglesite, cerussite, pyromorphite
Malachite: small crystal tufts
Microcline: in gneissic granite
Orthoclase: in gneissic granite
Pyromorphite: crystals yellow to green, with wulfenite
Pyrite: generally massive or intergrown crystals
Quartz: milky crystals up to 6″ long; associated with pyromorphite
Sphalerite: massive, dark red cleavages, crystals very rare

Most Interesting Minerals

Cerussite: massive; crystals
Pyromorphite: crystals, especially nice on quartz crystals
Wulfenite: small crystals with pyromorphite

Rare

Ankerite (?) : needs verification
Azurite: crystals, small
Cerussite: completely tubular crystals
Chalcocite: massive
Copper: native wires
Cuprite: small crystals
Descloizite (?) : needs verification
Erythrite: coating on fractured surfaces

Fluorite: crystals, small
Gersdorffite: crystals, not reported recently
Mimetite-Vanadinite: crystals; transitional in composition with pyromorphite
Pseudomalachite: green (copper phosphate) needles
Silver: wire, not reported recently
Sulfur: minute crystals, not reported recently

GEOLOGY

The lead, zinc, and associated minerals occur in granitic rock rich in microcline and orthoclase feldspar. This rock is called adamellite. Its major difference from true granite is that it contains less quartz, and hence is slightly more basic than granite. This adamellite is an intrusive igneous rock. The ore minerals crystallized later than the adamellite, localized along fractures and, in places, actually replaced the adamellite. Later weathering has altered some of the ore minerals, such as galena, to secondary minerals, such as cerussite, anglesite, and pyromorphite. The two abandoned mines south of Phoenixville mentioned here are only two of many which once were operated in this area. They were mined chiefly for lead, but also for zinc and silver. In 1835-36, lead-zinc ores from this district were used by the U. S. Treasury to make their standard weights and measures. This is an area of widespread lead-zinc mineralization, which implies that all of these minerals formed at about the same time and came from hot solutions which had the same source at depth.

The most important mine of the mineral belt of the Phoenixville district is the Wheatley mine. The Wheatley, Brookdale. and Phoenix mines were all located on the Wheatley lode.

REFERENCES

Miller, B. L. (1942), *Lead and zinc ores of Pennsylvania,* Pa. Geol. Survey, 4th ser., Bull. M 5, p. 31-43.

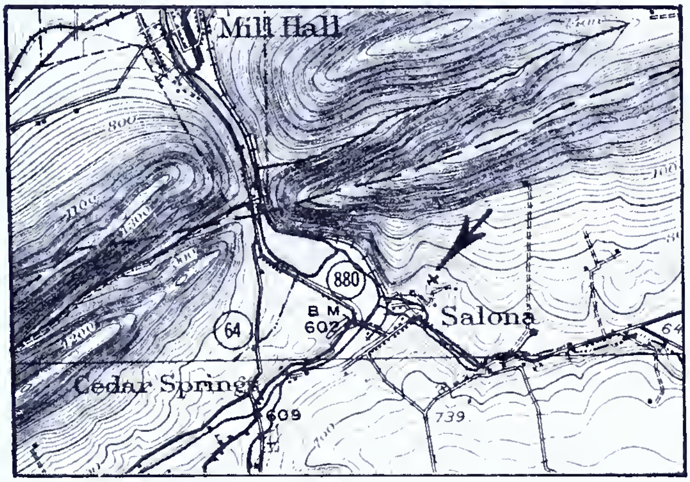
Stose, G. W. and Bascom, F. (1938), *Geology and mineral resources of the Honeybrook and Phoenixville quadrangles, Pennsylvania,* U. S. Geological Survey Bull. 891, 145 p.

CLINTON

SALONA CALCITE-DOLOMITE LOCALITY

LOCATION

The Salona quarry is located on the northeastern edge of Salona in Lamar Township. This active operation is situated in the west-central rectangle of the Lock Haven 15-minute quadrangle. Permission to collect must be obtained at the Lycoming Silica Sand Company's scales office. Do not confuse the operating company's name with the limestone rock being quarried at Salona.



MINERALS

Calcite: white to clear rhombohedral crystals; white cleavage rhombs

Dolomite: crusts of white, curved rhombic crystals; associated with calcite

Fluorite: small, light purple cubic crystals; associated with calcite and dolomite

Quartz: small transparent doubly terminated crystals; associated with calcite and dolomite

Rare

Native sulfur: small masses associated with cleavable calcite

GEOLOGY

The sedimentary rock quarried at Salona is limestone and dolomitic limestone belonging to the Loysburg and Hatter Formations of Middle Ordovician age. Very fine particles of calcite and minor dolomite are their essential mineral constituents. Millions of years ago, these small particles of sediment were compacted and cemented together to form rock. Folding and faulting stresses produced open fractures and brecciated zones in the rock. Water, moving downward or moving upward due to forces and pressures exerted by a deep rooted magmatic (hot) source, dissolved and carried away in solution some of the carbonate mineral constituents. The same water which dissolved mineral constituents, redeposited them in open fractures, brecciated zones, and solution cavities when conditions were favorable. Accumulations of cleavable calcite, calcite crystals, and dolomite crystals were free to form in the larger openings.

Calcite, in crystalline or crystal form, is the most abundant mineral at Salona. When dolomite crystals appear, they are usually associated with calcite crystals and an occasional quartz or fluorite crystal. Fluorite is usually considered a mineral of magmatic (hot) origin. Its presence at Salona indicates that perhaps some of the mineralizing solutions migrated upward from a deep seated hot source, and that the origin of sulfur may not be biogenic (see discussion of Nippenose Valley).

SIMILAR OCCURRENCE

Nippenose Valley Calcite Locality, Lycoming County

REFERENCE

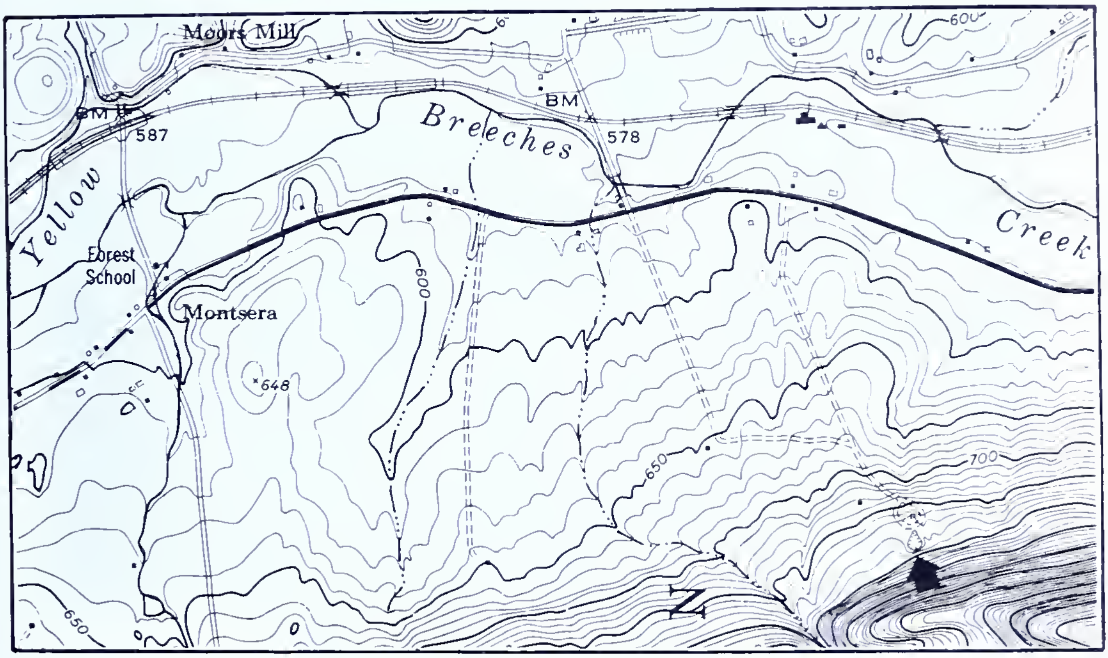
Hoff, Donald, Geology Curator, William Penn Museum, personal communication.

CUMBERLAND

PHOSPHATE LOCALITY

LOCATION

This locality is situated 3½ miles west of Mount Holly Springs and about 2¼ miles east of Huntsdale. The old mining pits and dumps may be reached by turning south off the Huntsdale Road onto a dirt road opposite a cannery. The dirt road ends at the dumps on the north flank of South Mountain. Topographic map readers will find this area located in the northeast rectangle of the Dickinson 7½-minute quadrangle. The mine property is privately owned and permission to collect must be obtained from the owners.



MINERALS

Apatite: associated with strengite
Beraunite: radial clusters of orange-red crystals
Cacoxenite: radial clusters of brown-orange crystals
Chalcedony: banded

Kaolinite: massive; associated with chalcedony, wavellite, strengite

Limonite: massive; coating on wavellite single crystals

Pyrolusite: dendrites; also on wavellite and chalcedony

Quartz: generally no crystal forms

Strengite: translucent grayish-white to slightly greenish radial clusters; may be concentrically banded in globular clusters

Turquoise: massive blue with quartz

Wavellite: white radial clusters of prismatic needles, botryoidal, massive; also grayish (Mn) or yellowish (Fe) resulting from included oxides; rarely in long prismatic single crystals with basal pinacoid termination

Exploration Trench

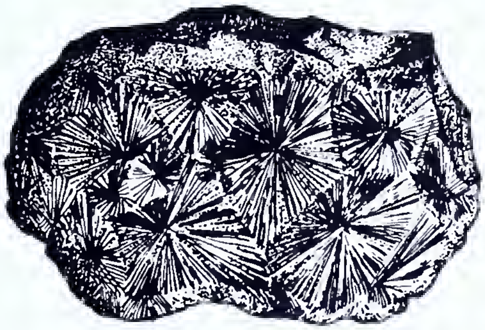
GEOLOGY

The wavellite is closely associated with the deposition of manganese. Crystal clusters often contain concentric black bands of pyrolusite; hence the two probably formed contemporaneously. The minerals occur in a mass of weathered clay. The phosphate replaces both clay and chert although the clay replacement is by far the more common. The chert occurs as irregular masses and contains fragments of both clay and quartz (a "breccia") which are likewise replaced by the phosphate. Thus the wavellite is probably a secondary mineral and the result of residual accumulation under weathering conditions. The occurrence is near the base of the Tomstown dolomite and near a fragmented (brecciated), and probably faulted, contact with the Antietam sandstone. The area was once quarried as a source of phosphate and iron ores, but is no longer considered to be commercial. Similar deposits occur all along the Appalachian Mountains.

REFERENCES

Ashley, George H. (1933), *The undeveloped mineral resources of Pennsylvania,* Pa. Geol. Survey, 4th series, Bull. M 18-A, p. 25-26.

Gordon, Samuel G. (1922), *The mineralogy of Pennsylvania,* Academy of Natural Sciences of Philadelphia Spec. Rept. No. 1, reprinted in 1959, p. 137.

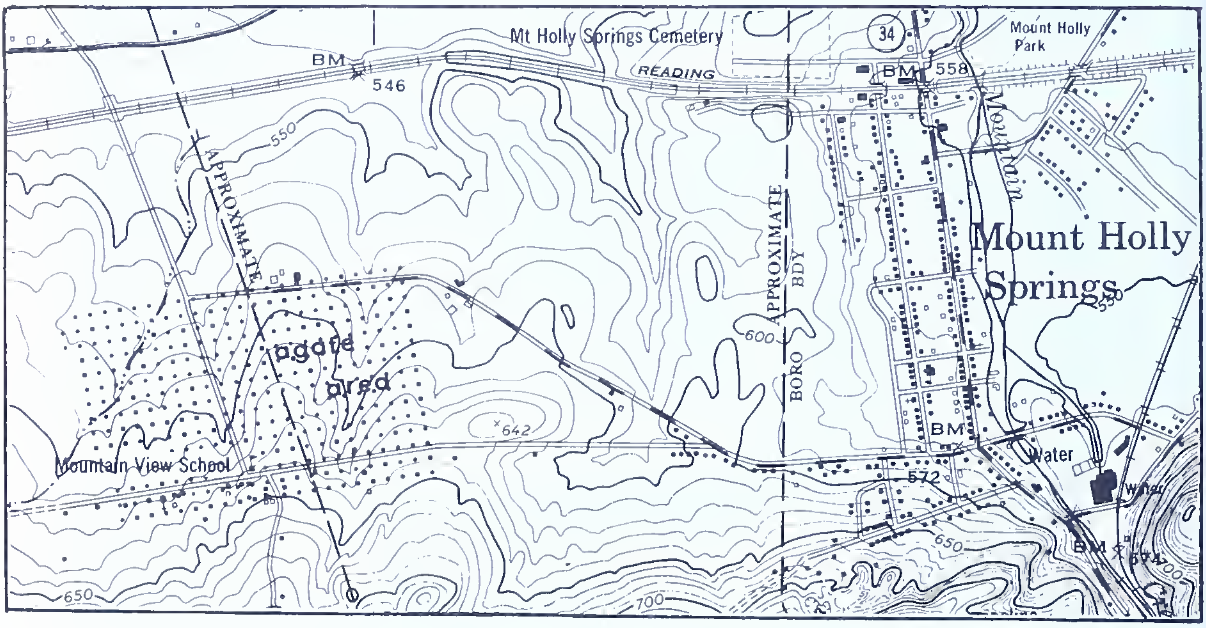


Wavellite

MT. HOLLY SPRINGS AGATE LOCALITY

LOCATION

The agate locality near Mt. Holly Springs is located 1.2 miles west of the town. If traveling south on Route 34, turn right (west) at the brownstone bank building on the corner; proceed 0.4 mile to where the road forks, bear right; at 1.2 miles west of Route 34 there is a farmhouse on the north side of the road and the entire field south of the farmhouse contains chalcedony and agate concretions. Some specimens may be found along fence rows where farmers have piled loose stones. The collecting area is located in the north-cental rectangle of the Mt. Holly 7½-minute quadrangle.



MINERALS

Agate: quality generally poor; rounded concretions

Chalcedony: light and dark gray banded in rounded concretions

Geodes: reported, but rare

GEOLOGY

The agate and chalcedony are found loose in the soil. They are derived by weathering from the dolomite rock which lies below this soil. The dolomite is a sedimentary rock having an overall composition very similar to the mineral dolomite. These concretions are often referred to as "thunder eggs," derived from an ancient Greek belief that they formed during thunder storms and dropped from the sky. The banding in most of these concretions is not sharp and is irregular. The white calcedony bands and patches are milky, a result of aggregates of differently oriented small quartz crystals. The darker bands tend to be brown rather than black.

Typical "Mt. Holly" Agate

HOW TO TUMBLE AGATES

Many agates or fragments of agates that you collect can be polished or tumbled to bring out their true beauty. The larger the agate the more desirable it is to cut and polish both halves, but, on the other hand, many agates and other hard minerals are found only in small or medium-sized fragments and these may be highly polished by the use of a tumbler. Today many collectors are making jewelry out of these tumbled "gems."

Each collector has his own secret formula for tumbling but the following procedure will give you excellent results:

A. The first step in tumbling your material is the "rough" stage. Place five pounds of rocks or minerals in your tumbler, the amount depending on its size. The tumbling container should be at least one-half full. Minerals or rocks of the same hardness should be used in each container. To every five pounds of material add one pound of silicon carbide grit No. 80 or 100. To this mixture add one ounce of steel B-B shot, ½ ounce of home laundry detergent, and one ounce of Baking Soda. After all these ingredients have been added, enough water should be placed in the container to completely cover the rocks. Clamp the lid securely and rotate the can or container for about one hour at a slow speed. After running for an hour, gas may build up inside the can and should be released. An inspection for gas build-up should be made twice in the next 24 hours of running but after that the can may run for approximately seven days without checking. It may be necessary to add more water because the water level within the can should always remain the same. The "rough" stage in the tumbling process should take about seven days. Each individual will have his own ideas on when the rocks are ready for the next step.

B. The second step in tumbling is the "smoothing" process. After the first step is completed, the contents should be washed thoroughly. Now place the rocks back into the cleaned container and add one pound of No. 220 grit with the same amounts of the other above mentioned ingredients. Run this mixture continuously for another seven days, then remove them and wash the rocks and container again. This time place the rocks in the tumbler with one pound of No. 400 or 500 grit and run them for another seven days or until all of the specimens have rounded edges.

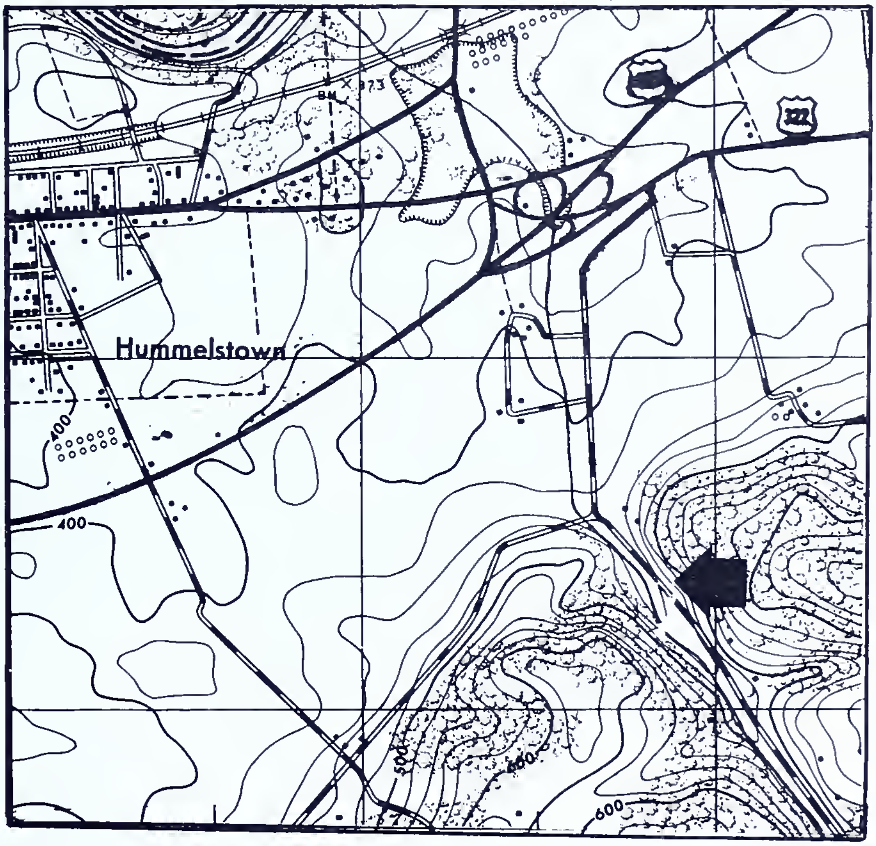
C. The third and final step is the "fine" polishing. For this step many commercial tumblers have a slightly different can or container. Place the rocks into the tumbler and add one pound of tin oxide for each five pounds of rocks plus the same amount of detergent and soda. Tumble this mixture for seven to ten days and the results attained should be specimens with an extra fine polish and high gloss.

DAUPHIN

HUMMELSTOWN HEMATITE LOCALITY

LOCATION

A specular hematite locality southeast of the borough limits of Hummelstown may be reached by turning south onto Valley Road at the clover-leaf interchange of Routes 322 and 422. Proceed one-half mile south on this road to an intersection; bear left and continue for approximately 0.2 mile. Collecting is best along the steep bank on the left (east) side of the road. Topographic map readers will be able to locate this area in the south-central rectangle of the Hummelstown 7½-minute quadrangle.



MINERALS

Garnet: dark red, very small crystals
Hematite: specular crystal plates up to 1″ or more in length
Quartz: massive

GEOLOGY

The hematite crystals occur in seams, or fracture fillings in red Triassic siltstone. Both the hematite and the garnet crystallization are the result of heat given off during the solidification of a nearby igneous diabase dike. This type of recrystallization by heat is called thermal contact metamorphism and is common near all diabase dikes in Pennsylvania. The source of the iron for the hematite was probably the iron present in the siltstone. Deep weathering along the hematite-filled fractures has decomposed the siltstone and, as a result, the mineral specimens are fragile.

SIMILAR OCCURRENCES

Cornwall, Morgantown, French Creek, Warwick, Wheatfield, Dillsburg.

REFERENCES

Gray, Carlyle and Lapham, Davis M. (1961), *Guide to the geology of Cornwall, Pennsylvania,* Pa. Geol. Survey Bull. G 35, p. 1-18.

Smith, L. L. (1931), *Magnetite deposits of French Creek, Pennsylvania*, Pa. Geol. Survey Bull. M14.

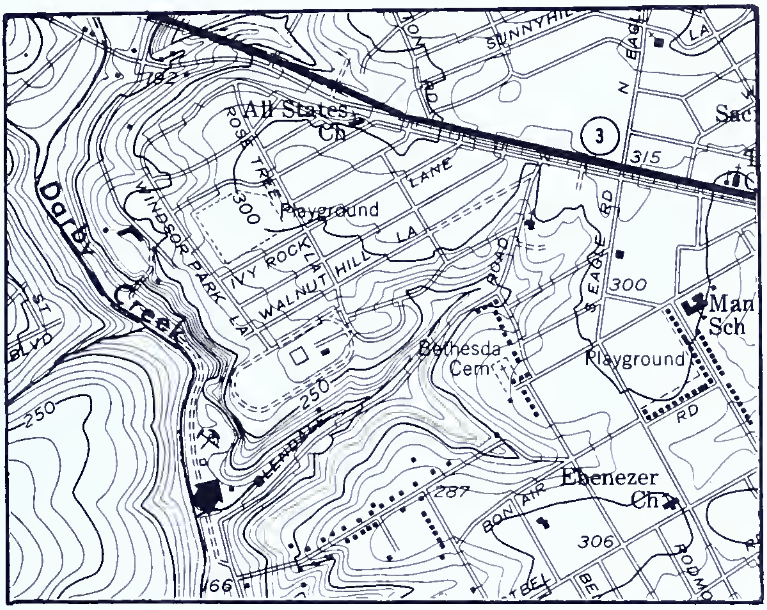
Spencer, A. C. (1908), *Magnetite deposits of the Cornwall type in Pennsylvania*, U. S. Geol. Survey Bull. 359.

DELAWARE

GLENDALE QUARRY BERYL LOCALITY

LOCATION

The Glendale quarry is located in the southwest corner of the north-central rectangle of the Lansdowne 7½-minute quadrangle. The entrance to the quarry is on Glendale Road just north of the point where Glendale Road parallels Darby Creek. This quarry is in Haverford Township about a mile south of the intersection of the West Chester Pike (Route 3) and Darby Creek. Permission to collect must be obtained from the quarry operator.



MINERALS

Beryl: crystals up to four inches in length
Feldspar: massive; crystals of microcline reported
Garnet: small crystals
Ilmenite: black crystal plates in quartz with muscovite
Muscovite: small books and flakes
Pyrite: small crystals
Quartz: massive

Rare:

Stilbite: crystal sheaves reported

Thulite: reported

Tourmaline: (schorl) crystals, generally not terminated

GEOLOGY

The beryl and associated minerals are found rather irregularly distributed through a coarse-grained quartz and feldspar rock. Because of this coarse texture, it is called a pegmatite. The unusual minerals found in pegmatites, such as at the Glendale quarry, are evidence that hot solutions entered the crust of the Earth from some source at greater depth, bringing in with them rarer elements like beryllium and boron. These hot solutions invaded the surrounding gneiss, cooled, and crystallized as a pegmatite. Thus, all the minerals formed at essentially the same time. The formation of garnet is probably the result of a chemical (and thermal) reaction between the pegmatitic solutions and the gneiss which they intruded.

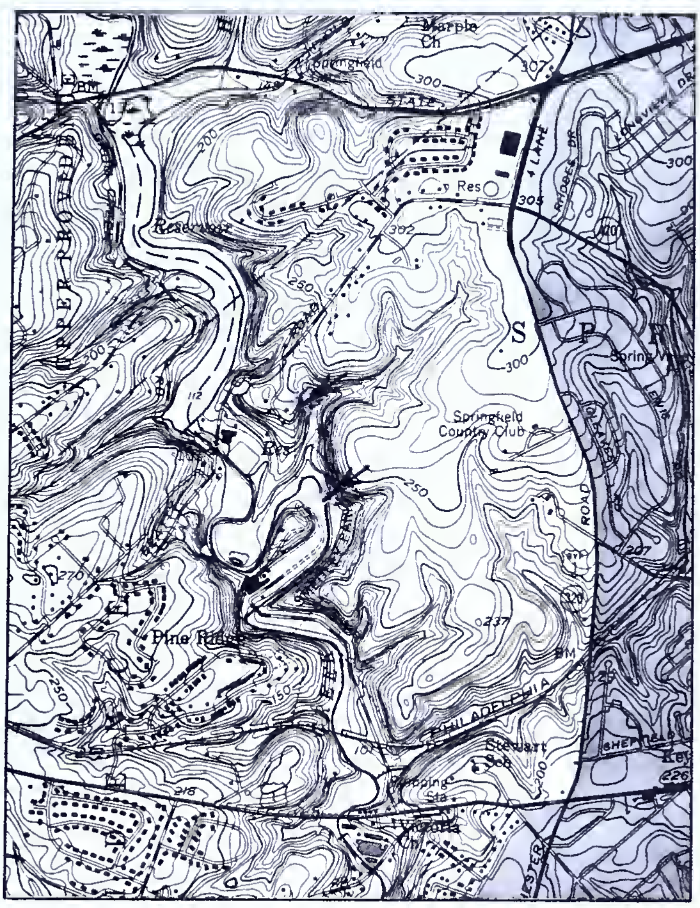
Searching for the Elusive Beryl Crystal at Glendale.

SMEDLEY PARK BERYL LOCALITY

LOCATION

Collecting areas are located in Smedley Park in Springfield Township (west-central rectangle of the Lansdowne 7½-minute quadrangle). Boulders along the south bank of Crum Creek near the center of the park provide a good collecting area. This site may be reached by taking a trail from the end of Paper Mill Road, about ½ mile north of U. S. Route 1, to the creek.

Another collecting site in the park is an old foundation of a house on the top of the hill in the northwestern section of the park.



MINERALS

Autunite: rare; in small flakes or coatings; fluorescent and radioactive

Beryl: crystals and crystal sections; blue-green and pale yellow to yellow-green; crystal sections up to several inches long and ½ inch in diameter; terminations rare

Feldspar: in pegmatite and gneiss

Garnet: small crystals or partial crystals; spessartine

Muscovite: in pegmatite and gneiss

Thulite: reported from area but difficult to find

Tourmaline: black, short crystal sections

GEOLOGY

The rock association of these minerals is a granitic pegmatite that is intrusive into Baltimore Gneiss of Precambrian age, or less commonly, into Wissahickon Schist. The house foundation material may have come from the Avondale quarry.

REFERENCE

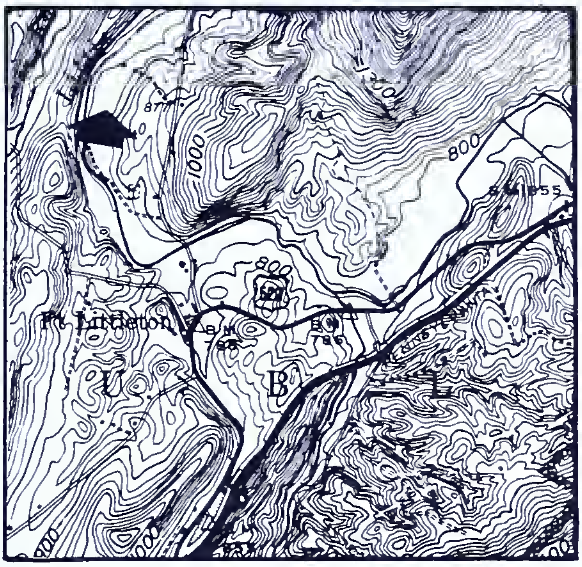
Waychumas, Glenn, *Keystone Newsletter,* Nov. 1967, p. 7.

FULTON

FORT LITTLETON BARITE LOCALITY

LOCATION

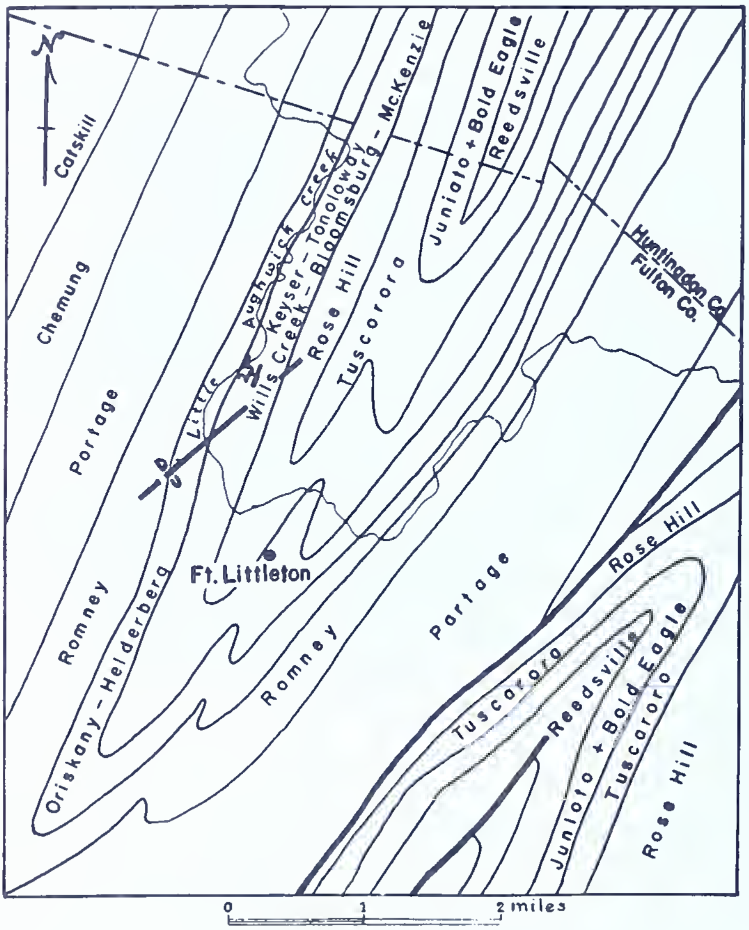
This locality is situated in the west-central rectangle of the Orbisonia quadrangle, about one mile northwest of Fort Littleton and 1½ miles northwest of the Fort Littleton interchange on the Pennsylvania Turnpike. An open pit and dumps are located in a farm pasture beyond the cemetery.



MINERALS

Barite: massive
Calcite: massive, cleavages
Chalcopyrite: small crystals and massive
Pyrite: small crystals
Quartz: massive

The barite is found within a fracture in limestone. This fracture is one along which there has been rock movement, and is called a fault. The movement of the limestone on either side of this fault has crushed pieces of limestone into different-sized, angular-shaped pieces, resulting in a finely crushed limestone called a breccia. The barite has replaced this fragmented limestone and has also filled in some open vugs within the fracture. The barite is believed to have been deposited from hot, rising solutions of igneous origin which carried the barium upward along the fault.



Geology of the Ft. Littleton Area

REFERENCE

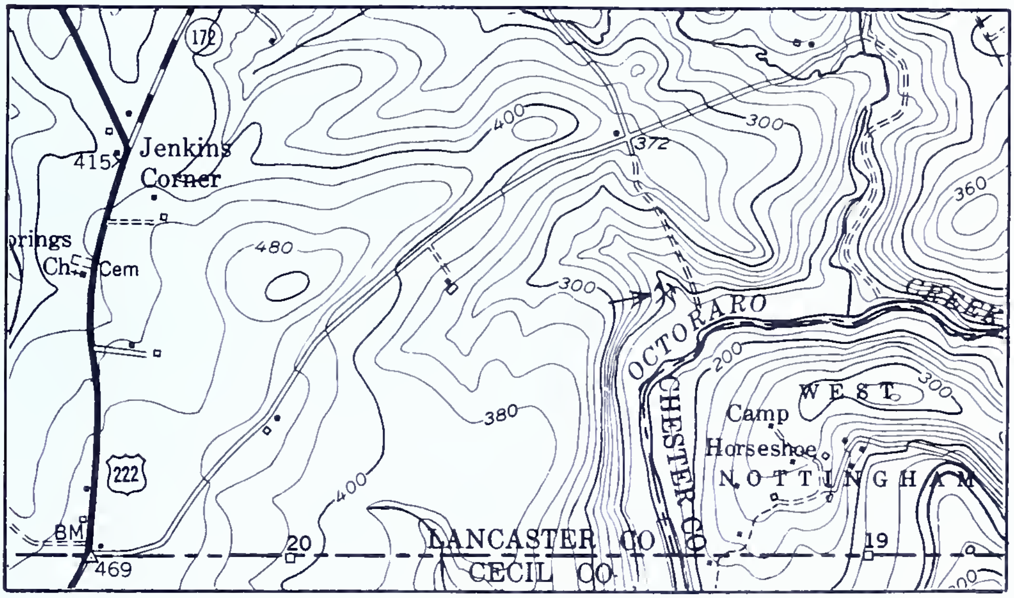
Socolow, Arthur A. (1959), *Geology of a barite occurrence, Fulton County, Pennsylvania,* Proc. Pa. Acad. Sci., v. 33.

LANCASTER

STATE LINE DISTRICT
CEDAR HILL QUARRY SERPENTINE LOCALITY

LOCATION

The Cedar Hill quarry is located in the northeast rectangle of the Conowingo Dam 7½-minute quadrangle, just north of the Pennsylvania-Maryland state line. The quarry may be reached by going east one mile from Pa. Route 222-72 at the Pennsylvania-Maryland state line. Road signs to the quarry mark the way. There is good collecting on the dumps near the quarry entrance, but the best specimens may be obtained from the quarry itself. Permission to collect must be obtained since the quarry is in operation. The quarry office is located beyond the crushers, opposite the working face of the quarry.



Mineral collecting at the Cedar Hill quarry is subject to the following restrictions from D. M. Stoltzfus and Son Inc., Talmage, Pa. 17580:

1. Collecting on Saturday afternoon and Sunday only;
2. Compensation to be given to company employee for his time of supervision of all mineral collecting activities;

3. A release signature from each collector; and
4. Two weeks notice by the collector (s).

These regulations must be complied with or permission to collect will not be granted.

MINERALS

Albite: massive, probably associated with chlorite-vermiculite in pegmatites; not found in place

Antigorite: massive serpentine and hard fiber; also "Williamsite"

Aragonite: crystal tufts; usually replaced by deweylite or magnesite

Artinite: in small, clear crystal hairs, or in mats of white satiny filaments

Aurichalcite: small crystalline coating

Bloodstone: associated with prase; rare

Brucite: crystal plates along fractures in the center of the quarry working face; frequently large flakes

Burkeite (reported): colorless to gray-white; greenish white fluorescence and blue phosphorescence; such a sodium-rich mineral is anomalous in serpentinite

Cacoxenite: small crystal clusters orange-brown in color

Chalcedony: banded and mammillary—both uncommon

Chlorite: variety clinochlore, crystals; associated with vermiculite in pegmatite dikes

Chromite: disseminated grains; rarely in veins south (Geiger Pit) and west of the quarry

Chrysotile: in small, cross-fiber veinlets, especially along the north wall

Crocidolite (?): fibrous blue coatings on fracture surfaces

Deweylite: white pseudomorph crystals and brown; white variety is fluorescent; also red from hematite staining; also yellow and green

Dolomite: massive, associated with magnesite, deweylite; also rarely in six-sided prismatic crystals

Epsomite: reported; white and powdery

Genthite: coatings; probably, like deweylite, a variety of serpentine

Heazlewoodite: very small grains in serpentinite; rare; not visible to the naked eye

Hydromagnesite: powdery coatings and clear, tabular crystals; possibly altering from brucite

Kammererite (var. of clinoclore): reddish-violet crystal plates up to ½ inch diameter; rare

Limonite: on weathered surfaces

Lizardite: within the massive serpentinite

Magnesite: massive; also in globular clusters and small stalactitic "pencils"; rare crystals with hydromagnesite probably scalenohedral with rounded faces and pencil shaped

Magnetite: disseminated grains in serpentinite rarely in crystals up to ½ inch; also massive with "picrolite" antigorite along shear planes; rare crystal rhombs in chlorite-talc schist

Malachite: small crystal clusters on weathered surfaces

Olivine: grains within serpentinite

Opaline silica: usually black to brown and bladed or wedge-shaped; also white to colorless botryoidal hyalite

Prase: massive, banded, botryoidal; uncommon; semi-precious quality

Pyrite: grains in serpentinite; may be, in part, heazlewoodite

"Pyroaurite": small white crystals with dehydromagnesite; may be another member of the pyroaurite group.

Pyrolusite: dendrites on fracture planes

Quartz: associated with dolomite and magnesite; cryptocrystalline; see chalcedony

Sepiolite (?): a questionable weathering product associated with deweylite

Stevensite (?): associated with deweylite; needs verification

Talc: at north contact of serpentinite; massive and rarely, flakes; small, complex, pale green monoclinic crystals very unusual

Vermiculite: crystal flakes in the center of pegmatites, northwest and southeast quarry walls

Mg-Ni hydroxide: yellow, hexagonal, mica-like plates having a powdery appearance; related to pyroaurite and brucite

Most Interesting:

- Brucite crystal plates, which are abundant, and rare small hexagonal crystals
- Fluorescent white deweylite and the emerald green variety which is nickel-bearing; small radiating groups after aragonite; pseudocrystals of deweylite on dolomite and magnesite; deweylite pseudomorphs
- Hydromagnesite: crystals
- Dolomite: prismatic crystals; a rare habit

Notes:

1. Zaratite, calcite, and ilmenite have been reported, but were probably incorrectly identified
2. Magnetite in crystals may be found in chlorite schist north and west of the quarry

GEOLOGY

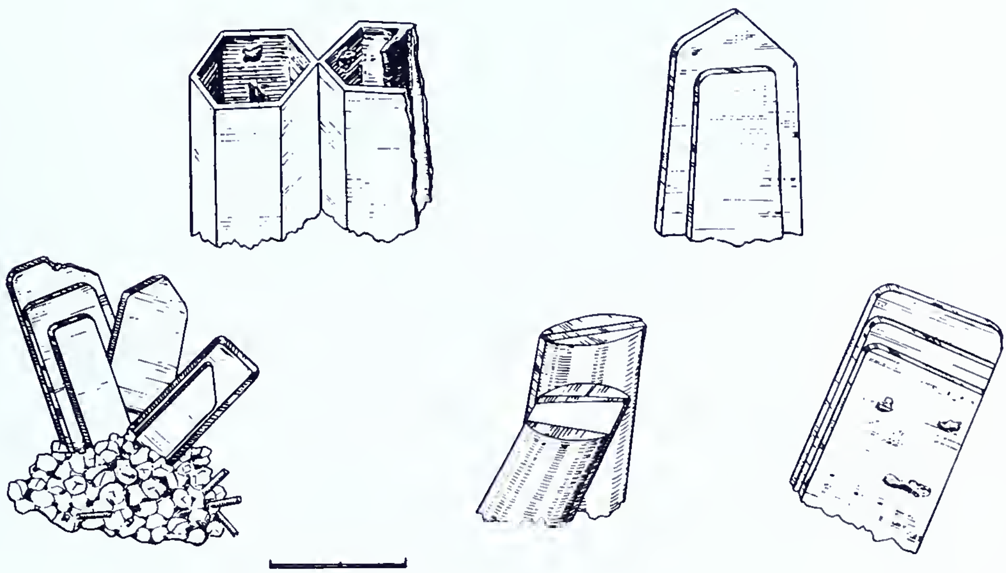
The geologic associations of the minerals found here are of two types. The chromite, magnetite, olivine, serpentine minerals, and pyrite are found within massive serpentinite. All the other minerals are found along fractures or within dikes in the serpentinite. Most of them represent an alteration of the earlier formed serpentine minerals, either by hydrothermal (heated solutions) alteration or as the result of weathering and groundwater action. The original rock, before becoming serpentinite, was an igneous dunite (olivine rock) with minor amounts of pyroxene, chromite, and magnetite. It probably intruded the surrounding rock about 450 million years ago. Many fractures and faults are visible in the quarry.

REFERENCES

Lapham, Davis M. (1960), *Geology of the Cedar Hill serpentinite quarry,* Pa. Field Conf. Guidebook, p. 35-38.

Lapham, Davis M. (1961), *New data on deweylite,* Am. Mineralogist, v. 46, p. 168-188.

Lapham, Davis M. (1962), *Geology of the Cedar Hill serpentinite quarry,* Internat. Mineralog. Assoc. Guidebook, Northeast Excursion, p. 43-49.

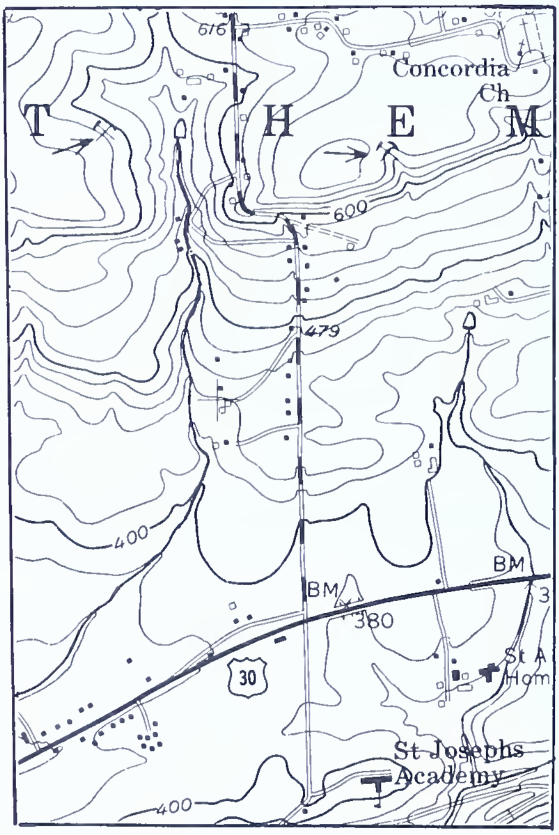


Pseudomorphs of Deweylite After Hexaganal Dalamite and Hydromagnesite, Cedar Hill Quarry

CHESTNUT HILL LIMONITE PSEUDOMORPH LOCALITY

LOCATION

This limonite pseudomorph locality is located in the central rectangle of the Columbia East 7½-minute quadrangle, one mile north of the intersection of Route 30 (Lincoln Highway) and the St. Josephs Academy road. The pseudomorphs may be found in the fields to the east and west of the road. Parking space for several cars may be found at the top of the hill. Grubb Lake and Mud Lake, about one mile to the northeast of the pseudomorph locality, are also good collecting localities for massive limonite and limonite geodes ("bombs").



Specimens of Limonite Pseudomorphs from Chestnut Hill

MINERALS

Chestnut Hill

- Lepidocrocite (reported): associated with goethite and limonite pseudomorphs
- Unusually fine limonite pseudomorphs after pyrite
- Mica: in the associated phyllite (schist)
- Pyrite, goethite and rarely heulandite (?) within pseudomorphs
- Quartz: in the associated phyllite (schist)

Mud and Grubb Lake:

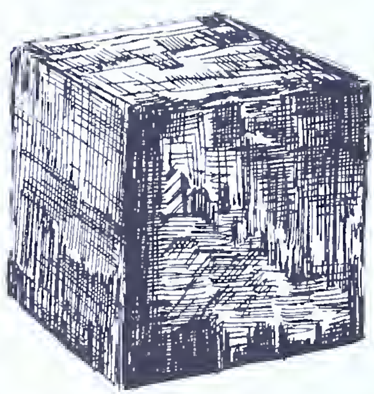
- Goethite Concretions
- Kaolinite Clay
- Limonite Concretions

GEOLOGY

The limonite cubes found in the fields along Chestnut Hill have weathered out of the rock lying underneath the soil cover. This rock contains a large amount of mica, with some quartz and feldspar. It is a metamorphic rock, and, because of its texture and layered character, is called a phyllite. The orientation of the mica plates into layers is the result of the heat and pressure applied to the rocks at the time they were folded. The limonite cubes have been altered from pyrite cubes. Some of these limonite cubes, called pseudomorphs (meaning "false form") after pyrite, still retain some of the original pyrite inside. This change from pyrite to limonite is probably the result of weathering, which attacked the pyrite and removed its sulfur content without destroying the original pyrite shape. Occasionally even the striations from the pyrite cube faces may be seen on the limonite pseudomorph faces.

SIMILAR OCCURRENCE

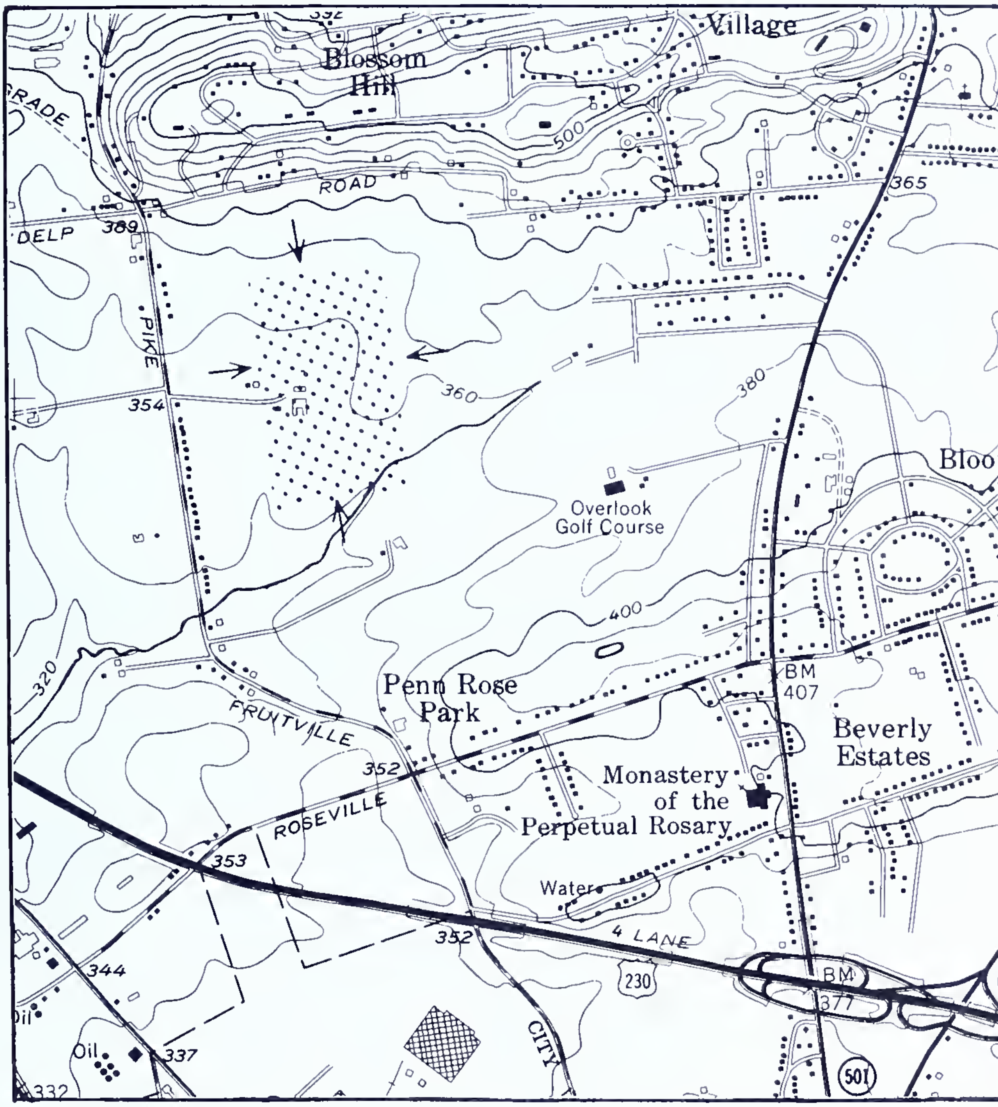
Fruitville Pike, Lancaster County, Limonite Pseudomorph Locality



Limonite Pseudomorph After Pyrite (Cube)

FRUITVILLE PIKE LIMONITE PSEUDOMORPH LOCALITY

LOCATION



This limonite pseudomorph locality may be found on the Lancaster 7½-minute quadrangle in the north-central and central rectangles. This locality comprises a general area marked on the above map by a dot pattern east of the Fruitville Pike approximately one mile north of the Lancaster City limits on the grounds of a tree nursery. The fields in which these pseudomorphs may be found are privately owned and permission to collect must be obtained from the owners.

MINERALS

Limonite pseudomorphs after pyrite in phyllite; pyritohedrons are notable at this locality; usually small

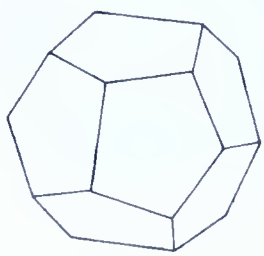
Quartz: rare crystals clear to milky; massive quartz

GEOLOGY

Limonite, a mixture of goethite and non-crystalline iron hydroxides, has replaced pre-existing cubes and pyritohedrons of pyrite. This replacement is the result of weathering processes and takes place from the outside of the cubes toward the inside. As a result many of the larger pseudomorphs still contain unaltered pyrite in the center. Occasionally even the old striations on the pyrite faces have been preserved by this replacement. The pseudomorphs (meaning "false form") occur in the Ledger Dolomite. This unit contains abundant pseudomorphs throughout Pennsylvania and suggests that the deposition of the original sediment may have been in an environment unusually rich in iron and sulfur.

SIMILAR OCCURRENCE

Chestnut Hill, Lancaster County, Limonite Pseudomorph Locality



Limonite Pseudomorph After Pyritohedron

MILLER QUARRY CALCITE LOCALITY

LOCATION

This locality is the H. R. Miller quarry which is operating for crushed limestone. The quarry is located ¾ mile east of Millersville and 1¼ miles southwest of Lancaster along a bend of Conestoga Creek (see map). It may be reached by driving along Wabank Road, either southwest out of Lancaster, or southeast from Millersville at the junction of Route 999 and Wabank Road. The locality is in the south-central rectangle of the Lancaster 7½-minute topographic map at coordinates 76°20′ latitude and 40°01′ longitude. Permission to collect must be obtained from the quarry office.

MINERALS

As in most quarry operations in limestone, the minerals which may be found are dependent upon the infrequent exposure by blasting of vugs or filled fractures within the limestone. As a result, both the quality and quantity of minerals to be found at any one time varies considerably. All of the following minerals were collected during the summer of 1964.

Calcite: in excellent crystals up to 4½ inches in length; crystals occur as scalenohedrons, positive and negative rhombs, and nailhead crystals; early formed crystals are frequently translucent and often contain small inclusions of pyrite (cubes and columnar), hematite, mica, and small unidentified needles; later formed crystals are white, nearly opaque, and occasionally fluorescent; phantom growths and etched faces are quite interesting

Dolomite: occurs as pink rhombs on dolomitic limestone; frequently coated with limonite and thus resembling siderite

Fluorite: purple; in masses or small cleavages

Hematite: inclusions in calcite; coating

Mica: uncommon; as inclusions in calcite

Pyrite: occurs as small cubes on and in early formed pyrite; also in unusual columnar crystals of stacked cubes which resemble rather thick needles

Pyrolusite: uncommon but excellent dendrites on calcite

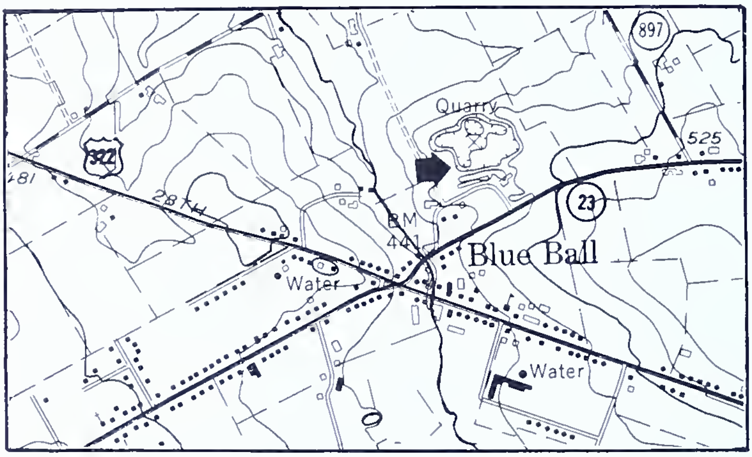
GEOLOGY

The above minerals occur in vugs and filled seams (fractures) in a limestone called the Conestoga Formation. In the area of Millersville this formation contains some small dolomite beds and phyllite, the latter being a mica-rich rock which is usually avoided in quarrying operations. The presence of fluorite indicates that chemical elements have probably been introduced into the limestone by mineralizing solutions. However, most of the mineralization, which is largely calcite and dolomite, originated from elements in the Conestoga Formation itself. The processes were, first, dissolution of the limestone; second, the solution of calcium, magnesium and other elements into percolating ground water, and finally, the redeposition of these elements during crystallization. The presence of phantom crystals and several different generations of crystal growth indicates that more than one such cycle occurred, separated by a small time interval. This locality is an excellent one for studying the various crystal forms of calcite.

SHOWALTER QUARRY CALCITE LOCALITY

LOCATION

The Showalter quarry is located in the north-central rectangle of the New Holland 7½-minute quadrangle. The quarry is about ⅛ mile north of Blue Ball on Route 23. Permission to collect must be obtained at the quarry office.



MINERALS

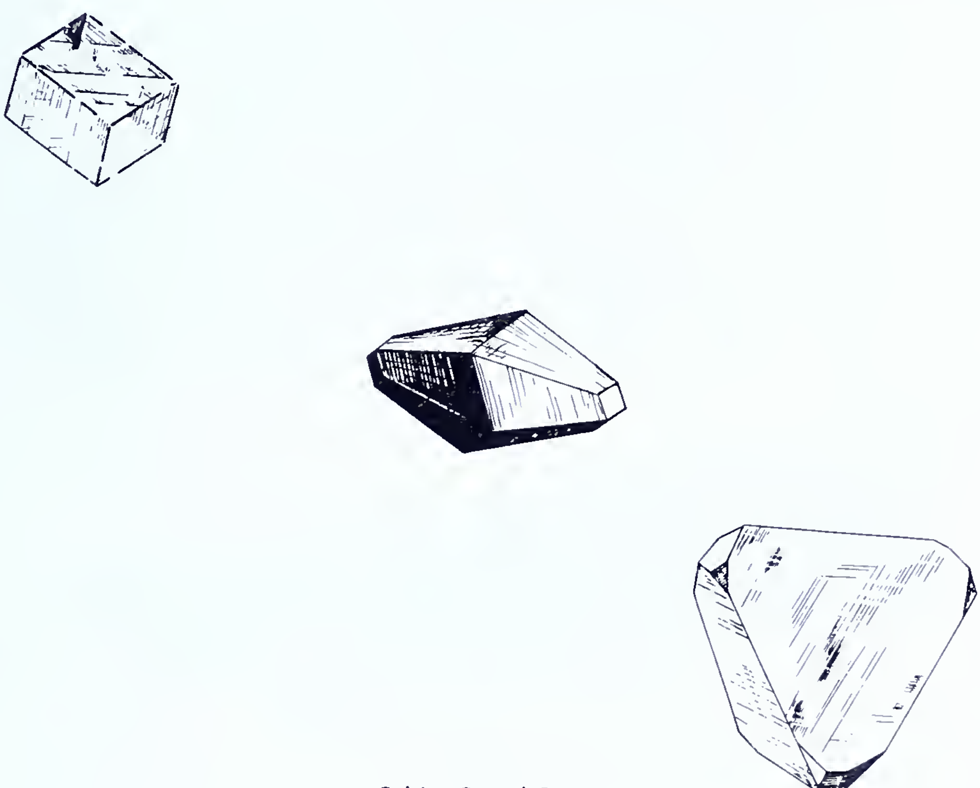
Analcime: rare crystals on limestone.
Calcite: dog-tooth crystals, pink and white; rarely in large groups
Chalcopyrite: small crystal tetrahedrons
Chlorite: generally not in visible crystals
Clay minerals: massive; probably kaolinite
Feldspar: orthoclase; massive, pink
Fluorite: uncommon, purple; usually cleavages
Hematite: specular, associated with chalcopyrite and pyrite
Pyrite: distorted cubes in phyllite rock
Quartz: generally massive
Rutile: uncommon

GEOLOGY

All of the above minerals occur in limestone, either scattered throughout the limestone, or as fillings of fractures and open cavities. Much of the limestone is impure, containing considerable mica and chlorite. Such beds are called phyllite. The scattered minerals formed during the dissolving away of limestone and then were deposited in place of the limestone. This is called replacement. Pyrite is the most common mineral formed in this way. The fracture and cavity fillings resulted in a greater variety of minerals and in larger crystals. The calcite crystals probably formed by solution of the limestone and then redeposition in open spaces in the rock. The presence of chalcopyrite and fluorite, and the presence of a quartz-feldspar pegmatite, indicate that these solutions were probably heated and introduced from an igneous source at some depth below the surface.

SIMILAR OCCURRENCES

Winfield quarry, Thomasville quarry, Bridgeport quarry



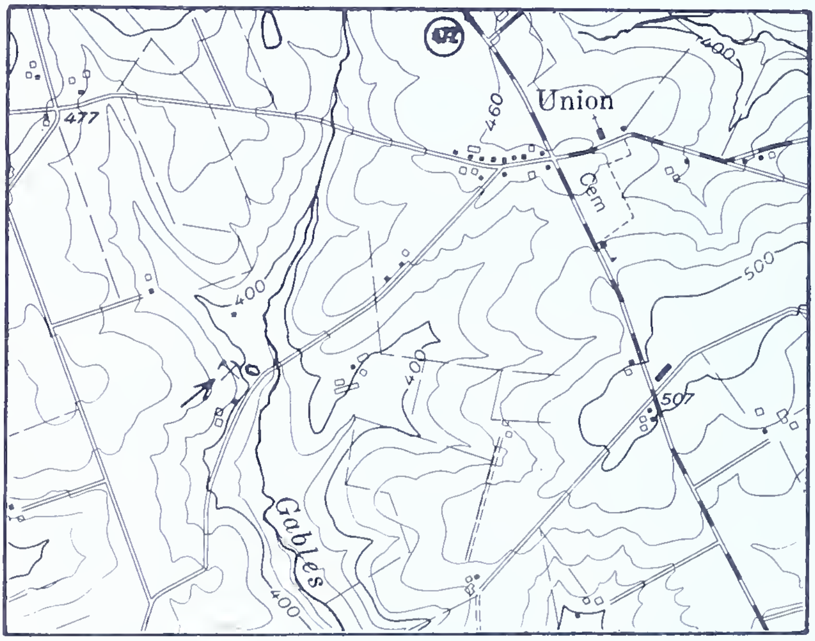
Calcite Crystal Forms

LOCALITY NOW CLOSED TO COLLECTING

STILLWELL QUARRY WILLIAMSITE LOCALITY

LOCATION

The Stillwell serpentine quarry in southern Lancaster County may be reached by taking Route 472 southeast from Quarryville, continuing on this route through the town of Kirkwood to the small village of Union. At the crossroads in Union turn west. At the first fork in the road take the left branch for approximately one-half mile. The quarry is just across the bridge over Gables Run. The quarry is in the north-central rectangle of the Kirkwood 7½-minute quadrangle.



MINERALS

Ankerite (?): probably magnesite
Antigorite: massive serpentine
Brucite: cleavages and small flakes
Chlorite: massive and crystal flakes
Chrysotile: asbestiform serpentine
Deweylite: red with hematite inclusions
Hydromagnesite: powdery coatings
Magnesite: cleavages and massive

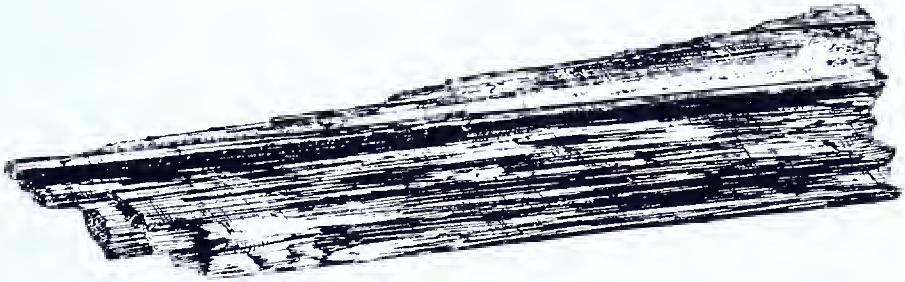
Magnetite: massive, grains, octahedrons in chlorite
"Picrolite": variety of antigorite serpentine in long, stiff fibers
"Williamsite": variety of antigorite; apple green with magnetite inclusions

GEOLOGY

The minerals occur in a serpentinite quarry. The "picrolite" and some of the "williamsite" are the result of shearing between neighboring blocks of serpentinite. The magnetite grains in serpentinite are part of the original rock, while the crystals in the chlorite are the result of heated solutions (hydrothermal) which altered the rock around the serpentinite mass. Veins of massive magnetite also are of hydrothermal origin and associated with sheared serpentinite and chlorite crystals. Deweylite, magnesite, and hydromagnesite fill fissures in the serpentinite and were among the last minerals to form. They are typical alteration products from weathering. The serpentinite is one of a belt of such rocks in Pennsylvania. Note that the "williamsite" and "picrolite" are in quotes because they are not valid mineral names.

SIMILAR OCCURRENCES

State Line District, Cedar Hill quarry and Wood mine, Lancaster County



"Picrolite"

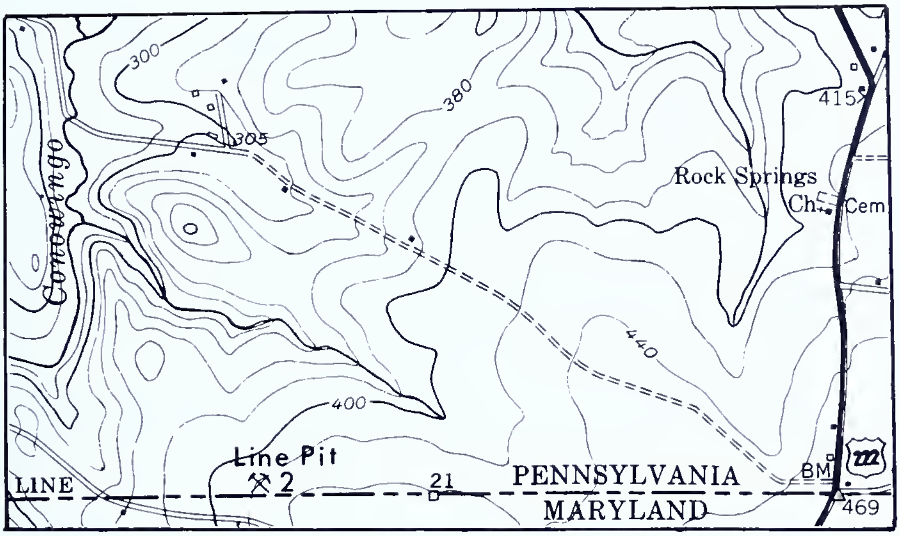
STATE LINE DISTRICT
WOOD MINE CHROMITE LOCALITY

LOCATION

The Wood mine is located in the northwest rectangle of the Rising Sun 7½-minute quadrangle in a meander of the Octoraro Creek, ½ mile north of the Pennsylvania-Maryland State line. The Line Pit and Lowe's mine (Location 2) are located in the north-central rectangle of the Conowingo Dam 7½-minute quadrangle, almost directly on the Pennsylvania-Maryland state line and one mile northwest of Rock Springs, Maryland. At both localities there is a deep pit and numerous mine dumps.

MINERALS

The same minerals with few exceptions have been found at both localities:



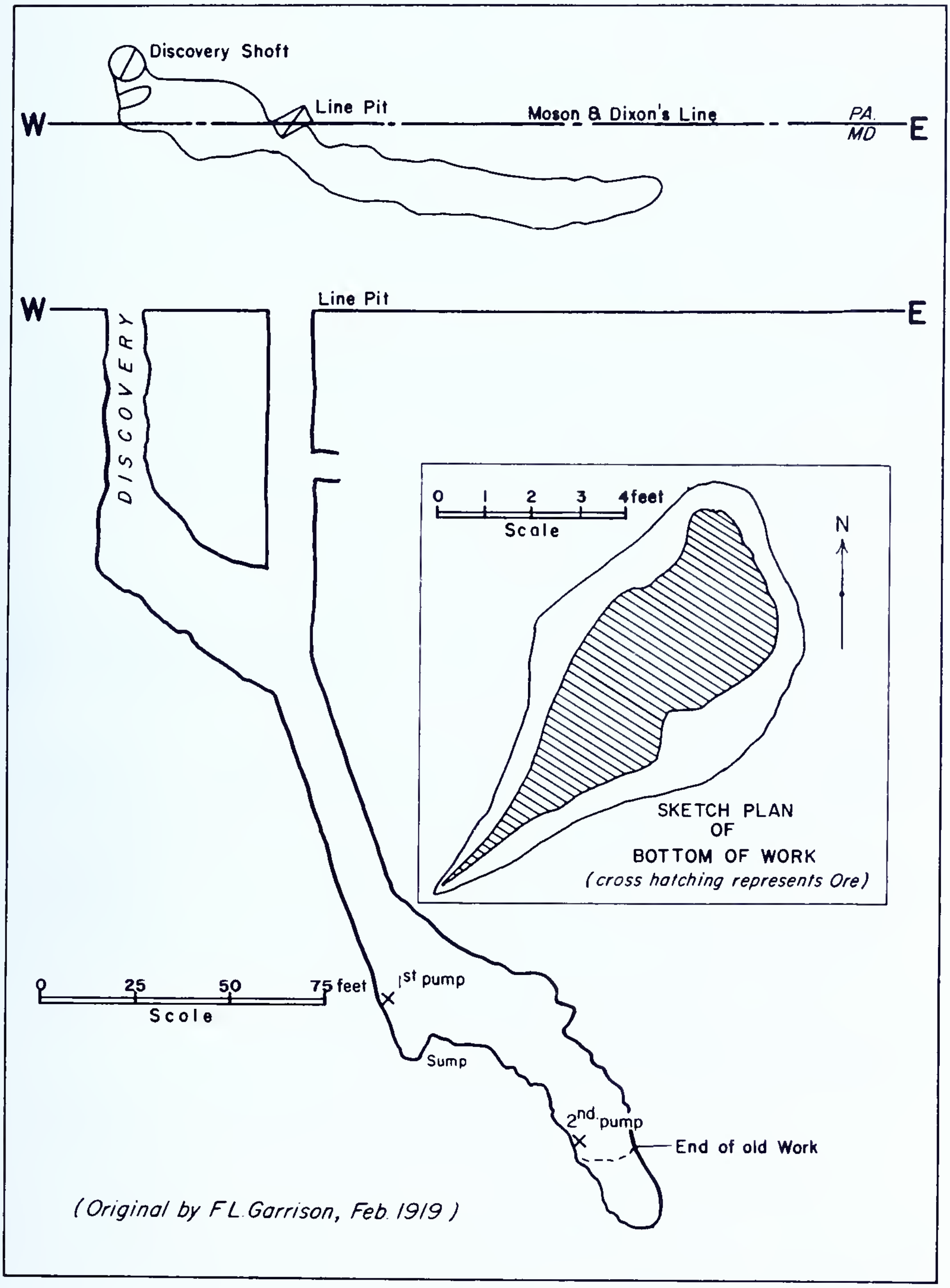
Antigorite: variety "williamsite," Location 2; also hard-fiber "picrolite"
Awaruite: in serpentinite at Location 2
Brucite: crystals on fractures; usually on serpentinite but rarely on chromite
Calcite (?) : reported; needs verification
Chalcedony: banded
Chlorite-vermiculite: at Location 2; lighter green than chlorite, to silvery or brownish green
Chrome-antigorite: fibrous; red to purplish red
Chromite: massive, also grains in serpentinite
Chrysotile: uncommon
Clinochlore: green crystals
Deweylite: Locality 1, tan-colored
Dolomite: intimately mixed with deweylite and magnesite; rarely in 6-sided prismatic crystals
Genthite: a questionable mineral species; green coating
Hydromagnesite: crusts on serpentinite; with magnesite
Magnesite: massive; at Location 1 in quarry face in bands
Magnetite: massive and grains
Talc: at Location 2
Zaratite: needs confirmation, may be Ni-deweylite

Uncommon to Rare:
- Aragonite: small crystal tufts and needles
- Cacoxenite: Locality 1, radiating needles
- Chalcocite (?) : needs verification
- Kammererite: crystal flakes of red to purple chlorite; on chromite
- Magnesite: stalactitic and globular crusts
- Millerite: needles:
- Pyrite: uncommon small cubes
- Pyroaurite: brownish-orange, hexagonal crystals associated with magnesite
- Uvarovite: reported
- Vesuvianite: reported at Locality 1

Most Interesting:
- Brucite: crystals
- Chrome-antigorite: a purplish, hard fiber serpentine
- Chromite: the chief ore of chromium
- Deweylite: a semi-crystalline mineral, often a mixture
- Kammererite: crystals
- "Williamsite": translucent, semi-precious serpentine

GEOLOGY

The large variety of minerals at the Wood Mine is the result of a complex geologic history. Each of the different geologic processes crystallized a particular suite of minerals, so that association becomes an important clue to the minerals which one can expect to find. The first event was the intrusion of a dark-colored rock (dunite) rich in olivine, and containing lesser amounts of enstatite, chromite and magnetite. The second major event was the introduction of hot solutions whose composition was approximately that of serpentine. These solutions also attacked the olivine-enstatite-chromite rock and formed new minerals in addition to the serpentine (antigorite and chrysotile) . The new minerals thus formed were magnetite, uvarovite, chrome-antigorite, and chrome-chlorite (kammererite) . Later, the composition of the thermal solutions became such that chlorite-vermiculite, clinochlore, and small amounts of pyrite



Section and Plan of Line Pit Mine.

were formed. Some magnesite and brucite may also have formed along fractures in the rock. At this time, there was no more chromium available to incorporate in definite minerals, so that although these minerals are found in serpentinite, they generally are not closely associated with chromite. Following this latter geologic event, weathering, ground waters, and relatively low temperature solutions resulted in the deposition of magnesite, hydromagnesite, calcite, chalcedony, aragonite, deweylite, cacoxenite, genthite, brucite, and zaratite along fractures and in vugs within the serpentinite rock.

SIMILAR OCCURRENCES

Many smaller chromite pits in the area, such as the Red Pit, Wet Pit, Geiger Pit, etc.; further to the east, Stillwell quarry, Kirk, Rhodewalt, Hilaman, and Pine Grove (Pearre and Heyl, 1959); see Cedar Hill quarry. The chromite deposits of California are similar (Siskiyou County, etc.).

REFERENCES

Duersmith, L. J. (1951), *Wood's chrome mine, Lancaster County, Pennsylvania,* Rocks and Minerals, v. 26, no. 5-6, p. 243-247.

Glass, J. J., Vlisidis, A. C., Pearre, N. C. (1959), *Chromian antigorite from the Wood's mine, Lancaster Co., Pennsylvania,* Am. Mineralogist, v. 44, p. 651-656.

Gordon, Samuel G. (1922), *The mineralogy of Pennsylvania,* Phila. Acad. Nat. Sci. Reprint no. 1 (1959), p. 205-206.

Lapham, Davis M. (1958), *Preliminary report on the chromite occurrence at the Wood mine, Pennsylvania,* Pa. Geol. Survey, 4th ser., Prog. Rept. 153.

Pearre, Nancy and Heyl, Allen (1959), *The history of chromite mining in Pennsylvania and Maryland,* Pa. Geol. Survey, 4th ser., Inf. Circ. 14.

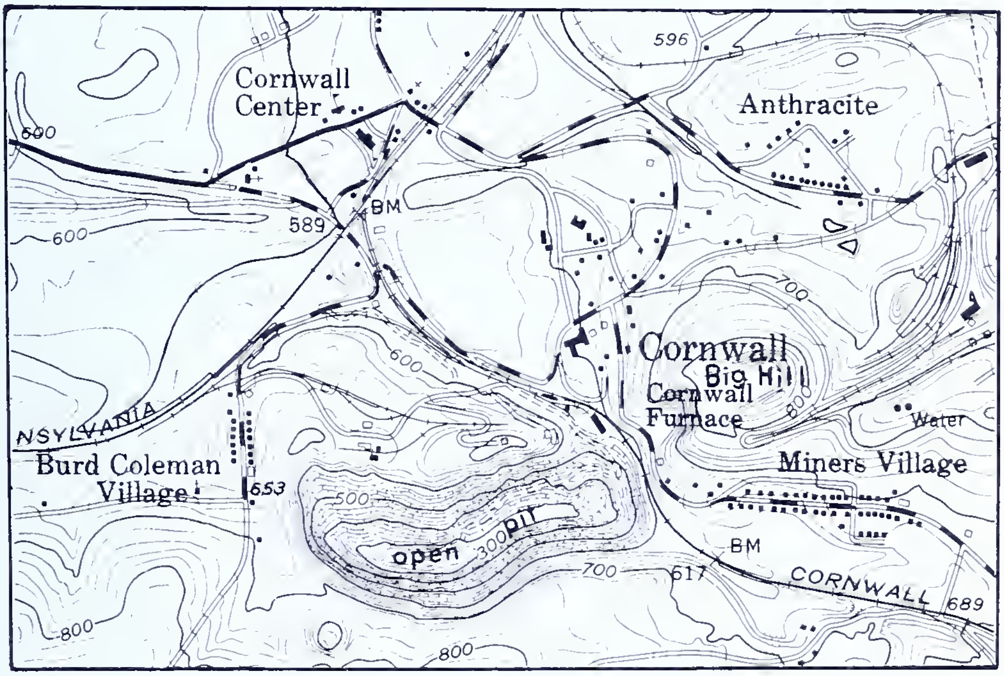
——————————— (1960), *Chromite and other mineral deposits in serpentine rocks of the Piedmont upland, Maryland, and Delaware,* U. S. Geol. Survey Bull. 1082K, 126 p.

LEBANON

CORNWALL MINE MAGNETITE LOCALITY

LOCATION

The Cornwall mine is located in the south-central rectangle of the Lebanon 7½-minute quadrangle, between the village of Cornwall and Miners Village. The open pit is now closed but an excellent view of it may be seen from the observation landing along old Route 322 and from several vantage points along new Route 322. Good collecting is still possible on the Big Hill dumps and at the base of the Big Hill along old Route 322. Groups (only) will be admitted, but permission must be obtained in advance.



MINERALS

Common

Actinolite (byssolite): in calcite vugs and compact fibers

Antigorite: green, massive serpentine; often in limestone; also in veins in diabase

Azurite: coating with malachite
Calcite: crystals and cleavages; with zeolites, in ore, in recrystallized limestone
Chalcopyrite: tetrahedrons, massive; in ore, limestone, and conglomerate
Chlorite: rarely crystal prisms; associated with actinolite
Chrysocolla: a questionable mineral species
Covellite: coating associated with chalcopyrite, chalcocite
Diopside: crystals rare; near top of diabase; in limestone and Mill Hill "slate"
Enstatite: in diabase pegmatite, especially Elizabeth Open Pit Mine
Epidote: generally massive; rarely prismatic crystals
Garnet: andradite and grossular crystals in conglomerate, limestone, and ore; up to one inch or more diameter
Hematite: hexagonal plates often replaced by magnetite; in ore and calcite
Heulandite: crystals in vugs; colorless to white
Ilmenite: in diabase pegmatite; crystal plates rare
Magnetite: octahedrons, dodecahedrons, plates, massive in ore and along top surface of diabase in small crystals
Malachite: coating and small crystals
Muscovite: in ore, usually greenish
Fe-Orthoclase: pink; in "granophyre" and "blue conglomerate" vugs; a rare mineral
Phlogopite: crystal flakes associated with actinolite
Prehnite: small crystal groups in vugs with Fe-Orthoclase and zeolites; also in Mill Hill "slate"
Pyrite: cubes, pyritohedrons; up to one inch across cube edge
Quartz: massive; also small crystals
Stilbite: small crystals and crystal clusters with calcite, pyrite and natrolite; also in fractures within diabase; sometimes with a pink tint
Tremolite: blades; less common than actinolite; in limestone

Uncommon

Adularia feldspar: reported by Hickok in a vein in diabase

Albite: in the groundmass of micropegmatite and aplite

Analcime: crystals with other zeolites, in vugs; rarely with triangular, etched growth faces

Andalusite: reported by Hickok; not verified

Anorthoclase: in "blue conglomerate"; no visible crystals

Apatite: associated with calcite in small veinlets; microcrystals

Apophyllite: crystals with zeolites, in vugs

Aragonite: usually a coating, crystals reported

Augite: in diabase

Bieberite: reported

Biotite: at the ore footwall with magnetite, pyrite crystals and in diabase with aplite veins; in "blue conglomerate"

Brochantite: reported

Brucite: in white to clear crystal flakes with serpentinized marble

Chalcanthite: blue, secondary crusts on waste dumps

Chalcocite: massive

Chrysotile: uncommon; at diabase—limestone contact

Clinozoisite: very small crystals associated with chlorite

Copper: native; wire; very rare today

Cordierite: reported by Hickok; not verified

Crednerite (?): reported by Hickok from the open pit

Cuprite: small crystals

Datolite: white to pale green; granular, small crystals; rare; in ore and aplite; also massive in vein from open pit

Elbaite: associated with ferriferous orthoclase in pink "blue conglomerate"

Erythrite: coating; may be mistaken for pink muscovite

Fluorite: cleavages and colorless cubes; in ore and in veins in diabase (Hickok); purple with calcite in veins in diabase

Galena: cleavages in limestone; found in other Lebanon Valley limestones, but sparsely

Garnet: grossular and andradite; X-ray data shows some of the grossular molecule to be always present

Gmelinite (?) : reported

Gypsum: massive; also selenite cleavages

Harmotome (?) : reported

Hornblende: in diabase; not visible to naked eye

Hypersthene: in diabase and diabase pegmatite

Kaolinite: alteration of feldspar

Labradorite: in diabase only

Laumontite: in white, sheaf groups of needles with chlorite, natrolite, apophyllite

Marcasite: intermixed with wurtzite crystals; difficult to see with hand lens

Melanterite: greenish-black incrustations

Mesolite (?) : may be present associated with natrolite and thomsonite

Microcline: in "aplite," "Mill Hill Slate," and "Blue Conglomerate"; not visible to naked eye

Millerite: small needle crystals with calcite in vugs

Mn-Na: muscovite: pink, powdery, resembling erythrite; rare

Natrolite: crystal hairs with other zeolites

Olivine (?) : reported in diabase

Pigeonite: in diabase only

Pyroaurite: small tan to almost white plates, with calcite; rare; similar to brucite

Pyrrhotite: small hexagonal crystals in recrystallized limestone

Rhodochrosite (?) : reported from the open pit; may be manganocalcite

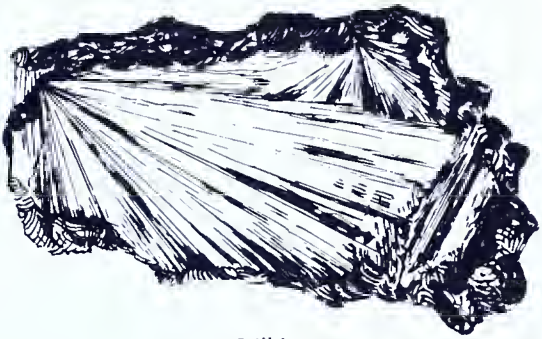
Rutile: in granophyre associated with ilmenite

Scheelite (?) : sub-microscopic intergrowth with ore magnetite from electron probe data

Sphalerite: small crystals

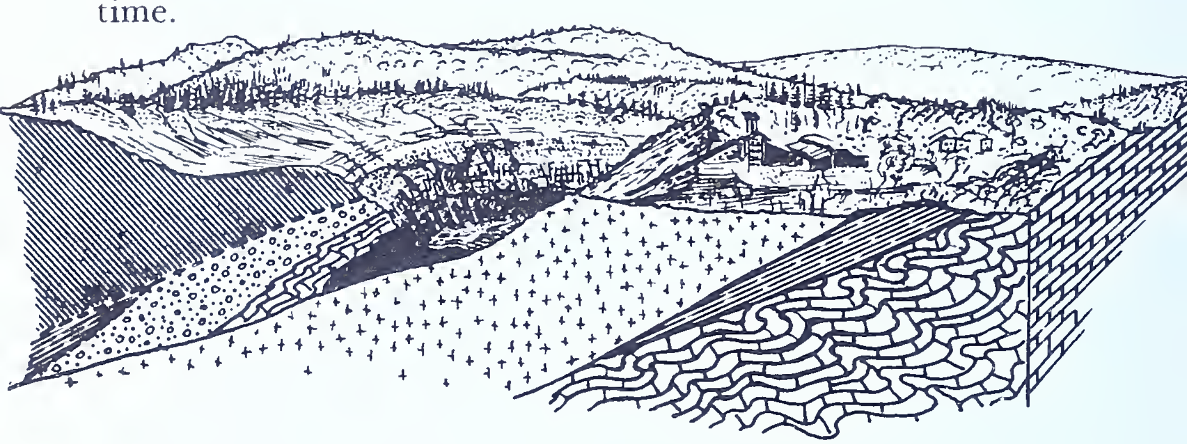
Sphene: very small crystals in aplite
Talc: associated with serpentine in veins
Thomsonite (?) : probably present with natrolite
Tourmaline: "thin, needlelike crystals in limestone" (Hickok) ; also in "blue conglomerate" (schorl)
Vesuvianite: generally massive
Wurtzite: 4H or 6H pyramidal crystals with marcasite, calcite; rare; micromount size

Most Interesting Minerals:
- Garnet crystals
- Magnetite crystals
- Fe-orthoclase
- Prehnite single crystals
- Pyrrhotite crystals
- Wurtzite crystals
- Zeolite crystals


Stilbite

GEOLOGY

The minerals found at Cornwall are associated with two major rock types: diabase and limestone. The diabase of Triassic age is an igneous rock of dark green to black color containing feldspars and pyroxenes, with minor amounts of biotite, ilmenite and hornblende. The diabase formed by crystallization of these minerals from a hot solution which cut upward through surrounding Cambrian and Ordovician limestone. This diabase, as it cooled and solidified, recrystallized some of the limestone into marble. Several minerals, such as diopside, actinolite, vesuvianite, epidote, and garnet, also formed in the limestone partly as a result of the heat from the diabase and partly as a result of the addition of some chemical elements from the final crystallization of diabase. Later, additional solutions spread outward along the top of the diabase into the limestone. The magnetite, hematite, pyrite, chalcopyrite, chalcocite, covellite, actinolite and chlorite formed at this stage. Sometimes they replaced the limestone, and sometimes they replaced the previously formed diopside and actinolite. The zeolites, sulfates, hydroxides, and copper carbonates crystallized last, filling open fractures and cavities. The result of this series of geologic events is that certain minerals occur together. Three such examples are the associations 1) magnetite-chalcopyrite-actinolite, 2) zeolites-chlorite-magnetite, and 3) garnet-tremolite-calcite-serpentine. The "blue conglomerate" mentioned above is a dark textureless rock with pink to orange-pink angular "fragments" (Fe-orthoclase) and is vuggy. The age of these deposits has been dated by the helium method at 190 million years, which is Triassic time.



Cross Section through the Open Pit at Cornwall.

SIMILAR OCCURRENCES

Morgantown, French Creek, Warwick, Wheatfield, Dillsburg.

REFERENCES

Gray, Carlyle (1956), *Diabase at Cornwall, Pennsylvania,* Proc. Pa. Acad. of Sci., v. 30, p. 182, 185.

Gray, Carlyle and Lapham, Davis M. (1961), *Guide to the geology of Cornwall, Pennsylvania,* Pa. Geol. Survey Bull. G 35. p. 1-18.

Hickok, William O. (1933), *The iron ore deposits at Cornwall, Pennsylvania,* Econ. Geol., v. 28, p. 193-255.

Lapham, Davis M. (1968), *Triassic magnetite and diabase of Cornwall, Pa.,* in *"Ore Deposits of the United States, 1933-1967,"* J. A. Ridge (ed.), Am. Inst. Mining, Metallurgical, and Petroleum Engineers.

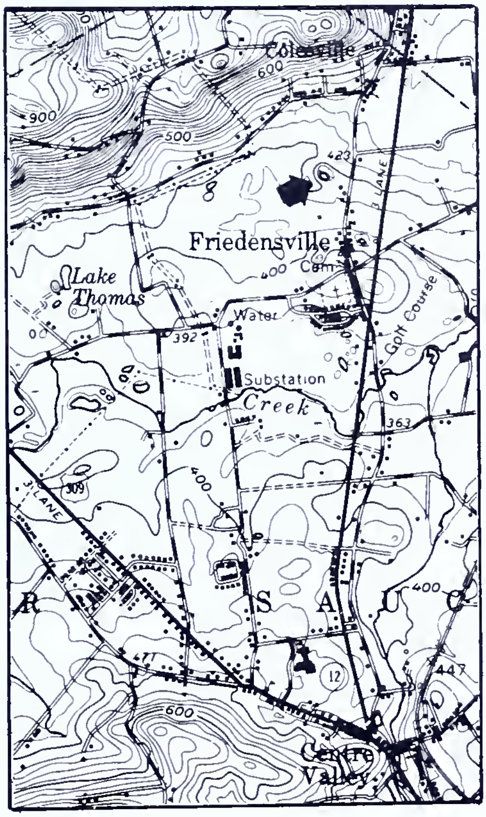
Spencer, A. C. (1908), *Magnetite deposits of the Cornwall type in Pennsylvania,* U. S. Geol. Survey, Bull. 359.

LEHIGH

FRIEDENSVILLE MINE SPHALERITE LOCALITY

LOCATION

The Friedensville mine is located along Route 12, four miles south of Bethlehem at the town of Friedensville, in the south-central rectangle of the Allentown quadrangle. The mine is currently owned and operated by the New Jersey Zinc Company. Permission to collect on the dumps must be obtained at the mine office located about ½ mile west of the cross-roads in Friedensville.



MINERALS

Aragonite: large crystal groups; fluorescent
Calcite: massive cleavages
Dolomite: massive
Galena (?) : reported but probably not present
Goslarite: on weathered surfaces
Greenockite: coating on sphalerite, hemimorphite
Hemimorphite: fine crystal groups
Hydrozincite: rare small crystals
Limonite: earthy
Pyrite: massive; small cubes uncommon
Quartz: generally massive
Sauconite: pale greenish to white clay; uncommon
Smithsonite: banded; uncommon

Sphalerite: black, very fine-grained; rarely light-green crystals
Spinel (ferrogahnite?): small crystals associated with quartz, pyrite

Most Interesting Minerals:
Aragonite
Greenockite on hemimorphite
Hemimorphite crystals
Sphalerite ore

GEOLOGY

The zinc ores and other associated minerals occur in limestone. Some of the mineralized limestone contains angular fragments of dolomite or limestone, and this rock is called a breccia. Both the limestone and the limestone breccia have been partly dissolved and then replaced by sphalerite, pyrite, and quartz. This replacement is often along the bedding planes of the limestone, thus yielding a parallel banding to much of the ore. All of the mineralized limestone sediments have been bent upward into a fold, called the Friedensville anticline, so that the zinc mineralization is not horizontal, but dips in the same direction as the folded beds. Significant rock movement along faults also occurred after deposition of the ore. Later, alteration of the sphalerite has produced secondary zinc minerals such as hemimorphite, smithsonite, and goslarite. This is one of the very few sphalerite occurrences which does not have any associated galena.

SIMILAR OCCURRENCES

Sinking Valley, Pennsylvania; Mississippi Valley lead zinc deposits

REFERENCES

Miller, Benjamin L. (1924), *Lead and zinc ores of Pennsylvania,* Pa. Geol. Survey, 4th ser., Bull. M 5, p. 54-84.

Socolow, Arthur A. (1959), *Friedensville mine, Pennsylvania,* Geol. Soc. America Guidebook.

LYCOMING

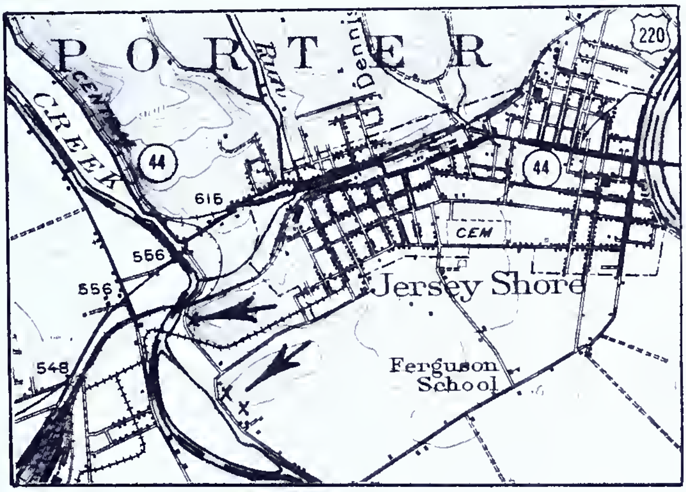
JERSEY SHORE

STRONTIANITE-CALCITE LOCALITIES

LOCATION

Three abandoned quarries along Pine Creek are located in the northeast rectangle of the Lock Haven 15-minute quadrangle. The quarries are approximately ½ mile southwest of Jersey Shore. These locations can be reached by turning south on a gravel road at the eastern terminus of the old U. S. Route 220 bridge over Pine Creek and continuing south about 3/10 mile where the northern quarry will be seen on a heavily wooded hill to the east. The two southern quarries are situated 4/10 mile farther south on the same gravel road.

Permission to collect at the two southern quarries must be obtained at the Allegheny Sand Inc. scales office. This company uses the old limestone quarry buildings to process fire clay shipped in from other localities.



MINERALS

Common:

Calcite: light yellow, white to clear and sometimes fluorescent; crystals of varied habits

Strontianite: tufts of small white radiating crystals associated with calcite

Uncommon:

Dolomite: white, curved, rhombic crystals

Fluorite: small, purple cleavages associated with calcite and strontianite

GEOLOGY

The abandoned quarries are located in an area underlain by limestones and calcium carbonate-rich shales of Upper Silurian age.

In the northern quarry, the Tonoloway Formation and the overlying Keyser Formation are well exposed. The Tonoloway limestone is thin bedded and fragile in appearance compared with the massive thick-bedded, fossil-rich Keyser limestone. A very sharp anticline (rock beds folded into a structure which is convex upward) may be seen near the center of the quarry. The most abundant mineralization is a short distance to the north of the center of this structure in the Tonoloway Formation. Lenticular-shaped, vuggy combinations of strontianite and calcite cementing eroded limestone fragments are found in this area. A small cave is located in the Keyser limestone south of the mineralized area. The Keyser Formation contains sizable lenses of chert near the cave.

The two southern quarries, where calcite crystals are commonly found, expose the Tonoloway and Keyser Formations.

SIMILAR OCCURRENCE

Winfield quarry, Union County

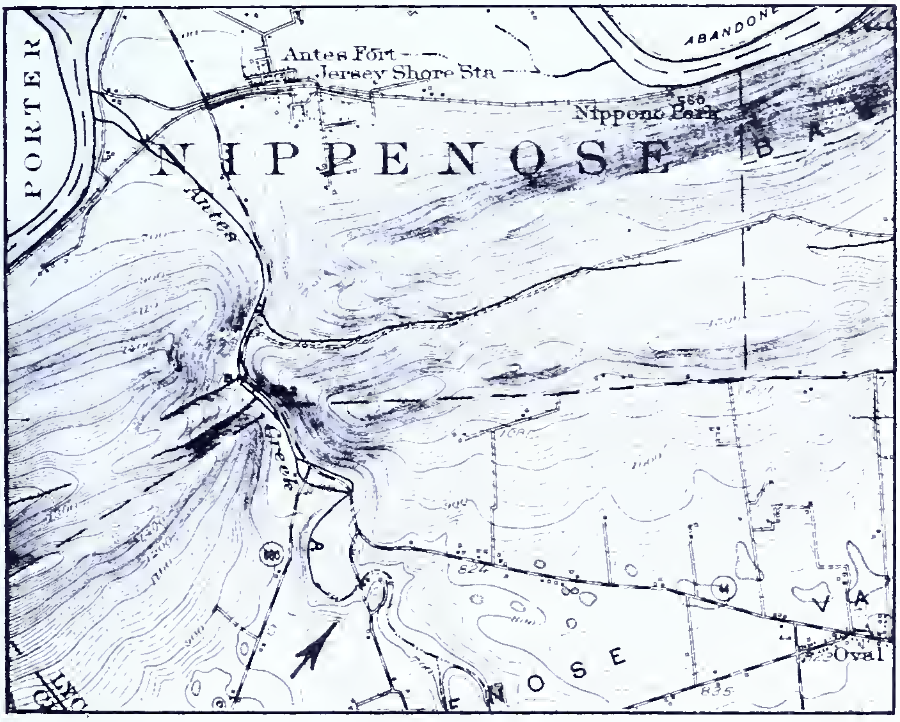
REFERENCE

Hoff, Donald, Geology Curator, William Penn Museum, personal communication.

NIPPENOSE VALLEY CALCITE LOCALITY

LOCATION

Lycoming Silica Sand Company's Pine Creek quarry is located 3 miles southeast of the junction of Pine Creek with West Branch Susquehanna River and in the west-central rectangle of the Williamsport 15-minute quadrangle. The active quarry lies approximately midway between Oval and Antes Fort on Pennsylvania Route 44. A sign along Route 44 marks the quarry entrance. Permission to collect must be obtained at the scales office. Do not confuse the operating company's name with the limestone rock being mined at the Pine Creek quarry.



MINERALS

Calcite: white to clear rhombohedral crystals; white cleavage rhombs

Pyrite: lenticular concretions in limestone

Rare

Native sulfur: massive, associated with calcite

GEOLOGY

This quarry exposes limestone of Middle Ordovician age. The general mode of calcite mineralization here is similar to that of the other limestone localities listed in this publication. However, the origin of the native sulfur is uncertain. This sulfur could have been produced by the action of microorganisms. Some chemical compounds containing sulfur as sulfide or sulfate can be reduced to sulfur during, and as a result of, the life processes of certain bacteria. Sulfur produced in this manner would have accumulated along with the sediments which form the limestone at this locality. Such sulfur is termed biogenic. Alternatively, sulfur can originate by inorganic chemical reduction or directly by introduction such as from sulfur fumaroles or geysers.

SIMILAR OCCURRENCE

Salona Calcite — Dolomite Locality, Clinton County

REFERENCE

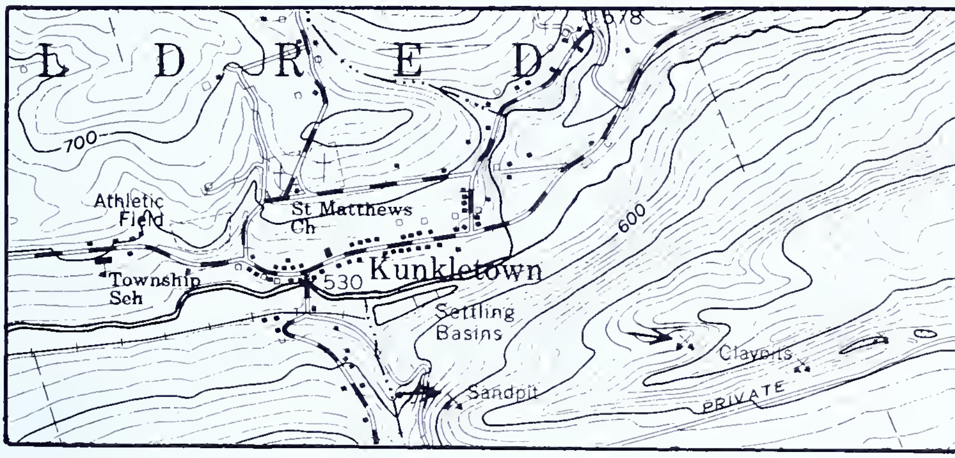
Hoff, Donald, Geology Curator, William Penn Museum, personal communication.

MONROE

KUNKLETOWN QUARTZ CRYSTAL LOCALITY

LOCATION

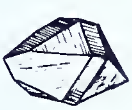
The Kunkletown quartz crystal locality is located just south of town, in the north-central rectangle of the Kunkletown 7½-minute quadrangle. The crystals may be found throughout the area but the best collecting is in an abandoned clay pit (see detailed map) to the east of the currently operated sand quarries and plant, and also along the stream banks. Permission to collect must be obtained at the sand company office before entering.

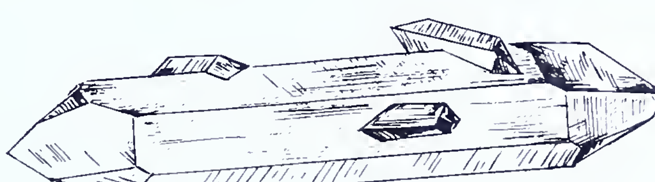


MINERALS

Quartz: excellent clear, terminated crystals up to several inches in length; some crystals are doubly terminated.

Azurite: Small blue crystals in and on quartz.





GEOLOGY

The quartz crystals are found in small vugs and fracture fillings (veins) in a medium-grained sandstone. The individual sand grains in the sandstone are held together by calcite, called a calcite cement. Weathering and ground waters readily dissolve the calcite so that the sandstone crumbles and disintegrates easily. Where this has occurred, hundreds of individual quartz crystals and crystal groups may be found loose in the sand. The formation of the quartz crystals was later than the sandstone since the quartz veins cut obliquely across the bedding planes of the sandstone.

REFERENCE

White, I. C. (1882), *The geology of Pike and Monroe Counties,* Pa. Geol. Survey, Prog. Rept. G 6, p. 126, 301.

Quartz Crystals Weather out of Sandstone and Are Recovered from the Surface in This Sand Pit.

MONTGOMERY

BRIDGEPORT DOLOMITE QUARRY

LOCATION

The Bethlehem Steel Company's quarry at Bridgeport is located approximately 0.4 mile southeast of Bridgeport along Route 202. This quarry is one of the largest in southeastern Pennsylvania and may easily be spotted in the northwest rectangle of the Norristown 7½-minute quadrangle. Permission to collect must be obtained.

MINERALS

Calcite: crystals in vugs
Chalcopyrite: small crystals
Dolomite: crystals (pinkish) in vugs
Goethite

Malachite: small, prismatic crystals and clusters; powdery coating
Quartz: crystals in vugs; jasper; chert
Sphalerite: massive and rare small crystals

GEOLOGY

The Bridgeport quarry is in Ledger Dolomite, the name of a dolomite formation of Cambrian age which is approximately 550 million years old. The dolomite beds alternate between nearly pure dolomite and an impure dolomite containing quartz and some clay minerals. The carbonate minerals formed in cavities which had been previously dissolved out of the rock by percolating solutions. Most of the sulfides probably formed in a similar manner by the leaching out of the rock of trace amounts of copper, iron, and zinc. The quarry is operated for crushed stone aggregate, flux, and refractory dolomite.

SIMILAR OCCURRENCES

Medusa quarry, York County.
Thomasville quarries, York County.

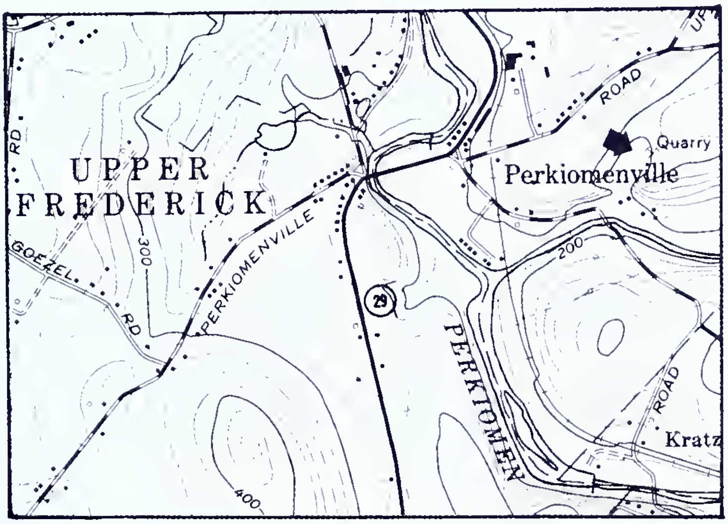
REFERENCE

Watson, Edward H. (1957), *Crystalline rocks of the Philadelphia area,* Field Trip #5, Guidebook for Field Trips, Atlantic City Meeting, Guidebook Series, The Geological Society of America, p. 152-180.

KIBBLEHOUSE QUARRY ZEOLITE LOCALITY

LOCATION

Kibblehouse quarry is located approximately 0.4 mile east of Route 29 at Perkiomenville and about eight miles southwest of the Quakertown exit on the northeast extension of the Pennsylvania Turnpike. Anyone familiar with topographic maps will find this quarry in the west-central rectangle of the Perkiomenville 7½-minute quadrangle. Permission to collect must be obtained.



MINERALS

Actinolite: byssolite fibers and small blades green to brownish black
Aragonite: crystal tufts, fluorescent
Axinite: flat, wedge-shaped brown crystals; up to ½ inch across; with epidote
Calcite: scalenohedrons, nail head, papier spathe; fluorescent
Chabazite: crystal rhombs
Chalcopyrite: small crystals
Chlorite: green crystal flakes
Chrysocolla (?): probably a mixture, not a valid mineral
Clinozoisite (?): small, gray-green crystals in quartz
Copper (?): needs verification
Epidesmine: reported; a variety of stilbite
Epidote: small crystals, massive

Fluorite: small purple crystals
Garnet: crystals rare; associated with epidote and pyrite
Heulandite: clear to yellowish crystals; twinned; good quality specimens common
Limonite: uncommon; pseudomorphs after pyrite
Magnetite: massive with parting and octahedral faces; found with garnet in quartz
Malachite: small needles and coatings
Montmorillonite: white, poorly crystalline, irregularly formed masses, usually coating calcite; unusual and may be mistaken for natrolite or aragonite
Natrolite: white powdery coating; stellate needles; single crystals
Orthoclase: small single, untwinned crystals, associated with actinolite
Pyrite: crystals on chabazite are fine cabinet specimens; with natrolite; crystallized before and after natrolite
Pyrolusite: dendrites
Quartz: small crystal groups and massive veins
Stilbite: radiating sheaves

GEOLOGY

The majority of the above minerals are found in vein fracture fillings or in vugs. The host rock in which they are found is the Triassic Brunswick shale. This sediment has been "baked" by the nearby intrusion of an igneous diabase dike also of Triassic age, but younger than the shale. Such a baked rock is called a hornfels. The actual baking process is called thermal contact metamorphism. Epidote, actinolite, garnet, and chlorite are typical contact metamorphic minerals which formed by recrystallization of the shale from the heat of igneous intrusion. The zeolite and carbonate minerals are, at least in part, the result of solutions from the diabase, given off either as it cooled or forming later as ground waters slowly dissolved the silicate minerals and redeposited their elements as hydrous zeolites, carbonates, and sulfides.

SIMILAR OCCURRENCES

Teeter quarry, Adams County; Dillsburg locality, York County

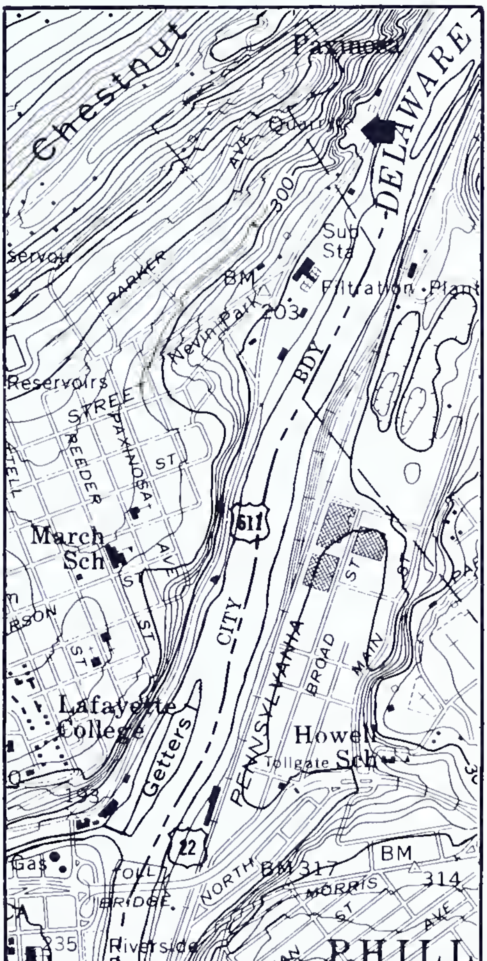
NORTHAMPTON

EASTON SERPENTINE LOCALITIES

LOCATION

The Chestnut Hill (C. K. Williams) quarries are located along Chestnut Hill on the west side of Route 611, 1.3 miles north of the intersection of Routes 22 and 611, in the north-central rectangle of the Easton 7½-minute quadrangle. This quarry is one of the best known and most exhaustively collected in the State, but at the time of this revision, mineral collecting is PROHIBITED at the Chestnut Hill quarries.

MINERALS



Common

- Actinolite: bladed, prismatic groups
- Aragonite: small crystals
- Augite: crystal sections
- Biotite: crystal flakes
- Bowenite (?)
- Calcite: small crystals but usually massive cleavages
- Chlorite: crystal flakes associated with vermiculite
- Chrysotile: asbestos
- Diopside: granular
- Dolomite: crystals rare
- Graphite: small flakes in limestone
- Lepidocrocite: reported, needs verification
- Malachite: coating
- Orthoclase
- Phlogopite

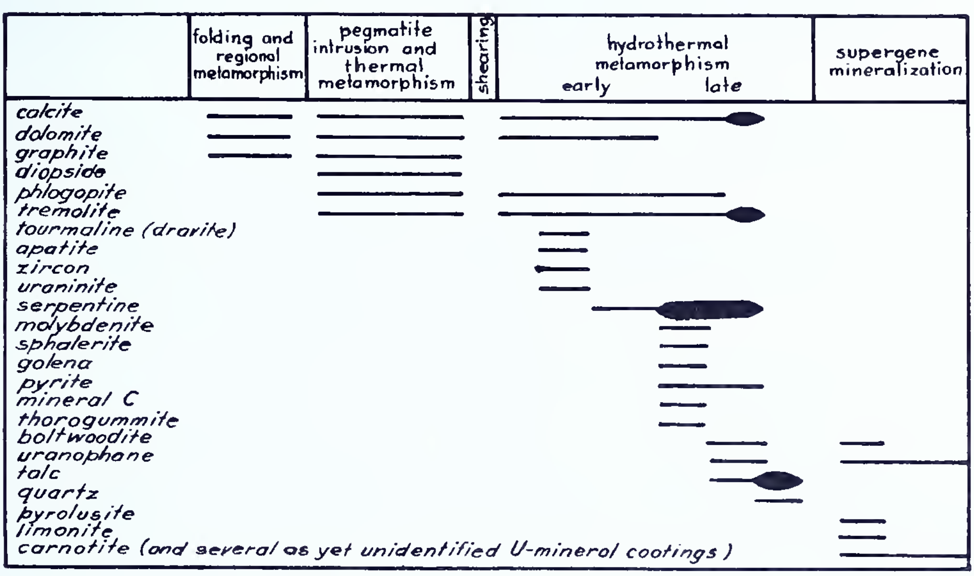
Pyrite: small crystals
Pyrolusite: dendrites
Quartz: massive and crystalline
Serpentine: antigorite and probably lizardite; massive
Talc
Tremolite: bladed prisms
"Williamsite": a semi-precious antigorite

Uncommon
Apatite: very rare; crystals
Autunite: fluorescent; coating of minute flakes
Barite
Boltwoodite
Brucite: small crystals
Carnotite: yellow coating
Celestite: reported
Chalcopyrite: small crystals reported
Epidote: crystals very rare
Fluorite
Galena: cleavages
Molybdenite
Phosgenite: reported
Sphalerite: pale brown in marble; also greenish yellow
Sphene: rare crystals
Strontian calcite
Strontianite: reported
Thorianite: high-thorium uraninite; black; radioactive
Thorogummite
Tourmaline
Uraninite
Uranophane
Vermiculite: interleaved with chlorite
Vesuvianite: reported
Zaratite: this species needs verification
Zircon

Most Interesting Minerals:
Uranium minerals which are scarce

GEOLOGY

All of the above minerals are found in a limestone which has been highly altered by solutions and intruded by other rock types. The limestone has been recrystallized into marble. This resulted in the formation of tremolite, phlogopite, diopside, and vesuvianite. It has also been altered and replaced by solutions carrying serpentine minerals. In the Chestnut Hill Quarries, there is very little marble remaining. Almost all of it has been converted to serpentinite. Actinolite, serpentine ("williamsite"), and asbestos are all associated with this stage in the geologic history of this deposit. Following this, the rock was cut (intruded) by acidic solutions rich in quartz and feldspar. These solutions crystallized into a coarse-grained rock called pegmatite. The chlorite, tourmaline, celestite, fluorite, uranium minerals, and several other unusual minerals are associated with this phase of geologic activity. Lastly, weathering and ground water have formed brucite, aragonite, malachite, carnotite, and vermiculite by alteration from some of the earlier crystallized minerals. These are generally found along fractures and on open rock surfaces. The age of the major period of mineralization is probably Precambrian.



Sequence of Mineral Formation at Easton. Calcite, Dolomite and Graphite are Earliest; Uranophane and Carnotite are Latest (from A. Montgomery)

REFERENCES

Miller, B. L. (1939), *Geology and mineral resources of Northampton County, Pennsylvania,* Pa. Geol. Survey, 4th ser., Bull. C 48, p. 435, 463

Montgomery, Arthur (1955), *Paragenesis of the serpentine-talc deposits near Easton, Pennsylvania,* Proc. Pa. Acad. Sci., v. 29, p. 203-215.

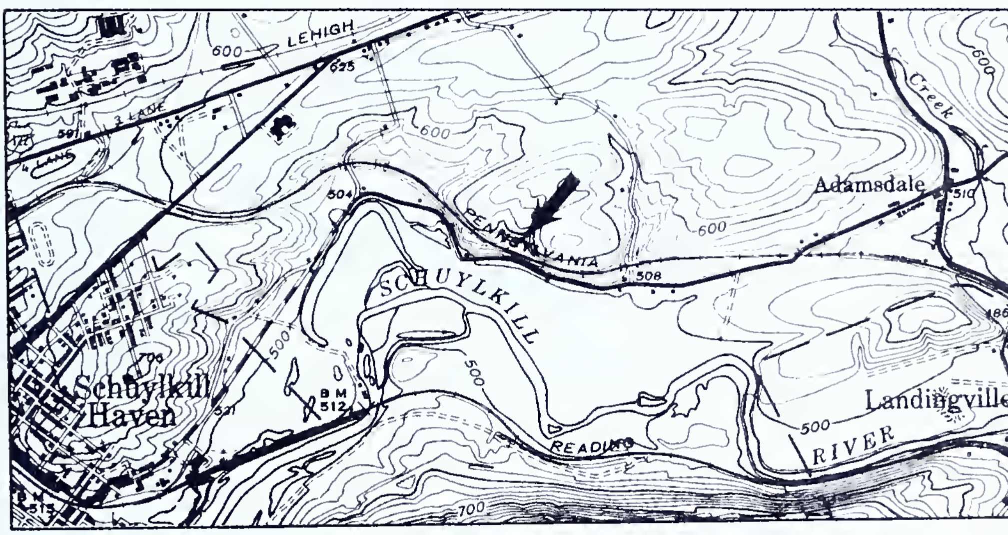
——— (1957), *Three occurrences of high-thorian uraninite near Easton, Pennsylvania,* Am. Mineralogist, v. 42, p. 804-820.

SCHUYLKILL

GALENA LOCALITY

LOCATION

On the Pottsville 7½-minute quadrangle, this quarry is located on the road between Adamsdale and Schuylkill Haven, 1.1 miles west of Adamsdale, on the northwest side of the road.



MINERALS

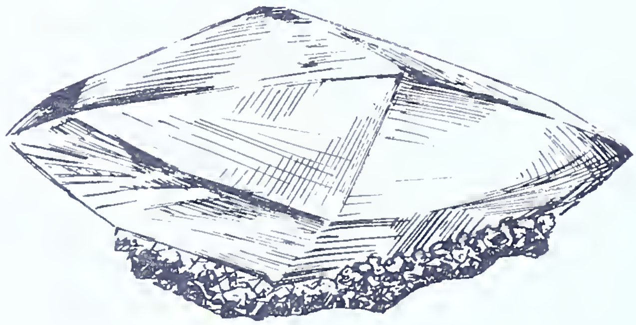
Calcite: crystals uncommon
Galena: small masses, cleavages, partial crystals
Limonite
Quartz: small crystals

GEOLOGY

The quarry contains the Palmerton sandstone lying above a limestone, probably Kaiser, that was at one time quarried. The calcite is associated with secondary crystallization from resolution of the limestone. The quartz is associated with the sandstone. Galena is probably an introduced replacement mineral.

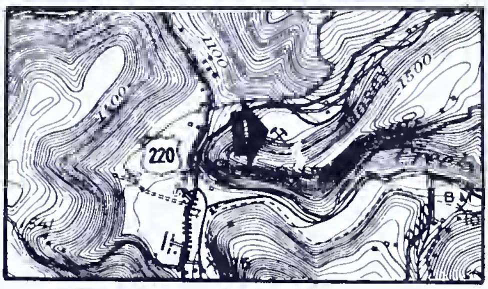
REFERENCE

Sevon, William, Geologist, Pa. Geol. Survey, personal communication.



SULLIVAN

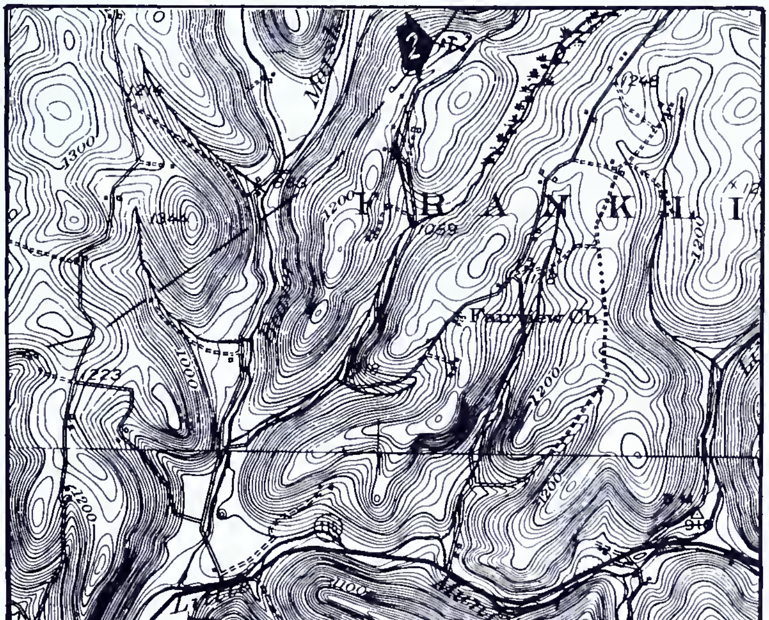
COPPER-URANIUM LOCALITIES



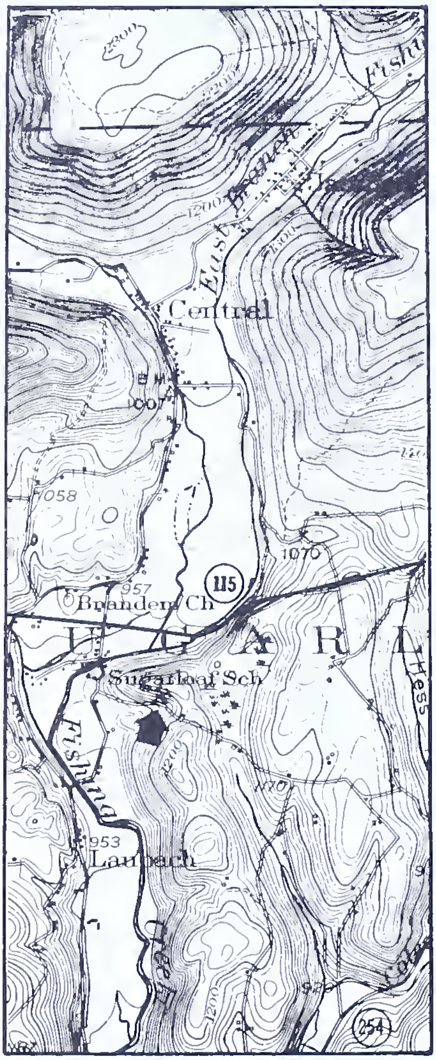
LOCATION

Occurrence #1—This occurrence is located in the east-central rectangle of the Eagles Mere quadrangle on Route 220 about 0.5 mile north of Sonestown. Look for a secondary road on the north side of Route 220. Turn on a small driveway opposite the secondary road for about ¼ mile south to a vertical bank which has been partly cleared. The mineralized layer is exposed on this vertical hillside for a distance of nearly 300 feet.

Occurrence #2—This occurrence is located in Lycoming County in the southeast rectangle of the Eagles Mere quadrangle. Take Route 115 east from Hughesville to Lairdsville. At about one mile northeast of Lairdsville, turn north off Route 115 and



proceed for 0.6 mile to a fork in the road, and bear right. The road branches again about 1.2 miles north of Route 115; bear left. At about 2.7 miles from Route 115 look for an old abandoned farm house on the north side of the road. An open pit has been dug directly behind the farm house. The uranium-bearing layer is on the vertical face of the open pit.

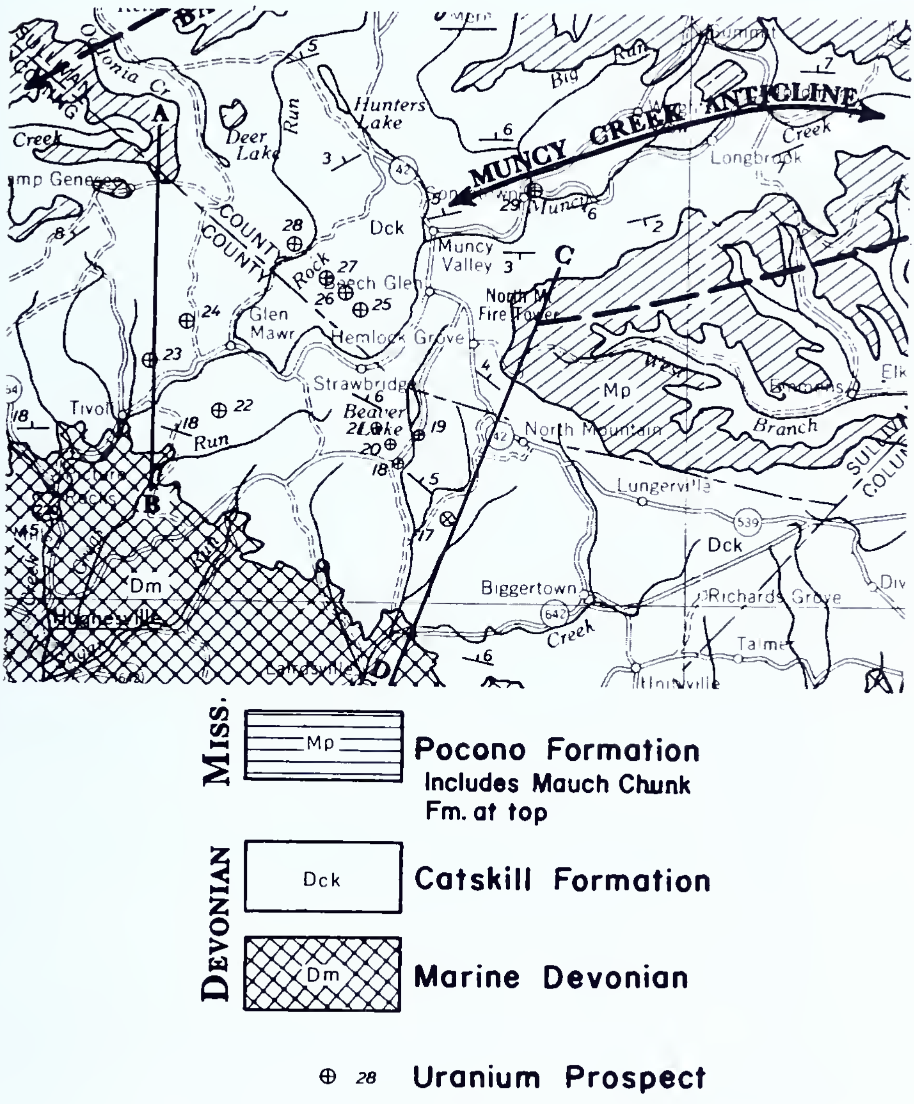


Occurrence #3—This site is located in Columbia County in the south-central rectangle of the Laporte quadrangle. To reach this locality, take Route 154 south through Central. Cross Fishing Creek and pass Sugarloaf School. South of Sugarloaf School turn east and proceed for about ¼ mile. Park near a small pond in the pasture on the south side of the road. This occurrence is on the opposite (north) side of the road on the wooded hillside about ¼ mile from the road. There is no path or roadway to this occurrence. The mineralization can be observed in a trench about 100 feet long and one foot deep. Several small dumps and stock-piles are near-by.

MINERALS

Azurite: coatings associated with other copper minerals
Barite: massive
Bornite: associated with chalcocite

Chalcocite: massive; uncommon
Chalcopyrite: massive
Chrysocolla: coating; probably a mixture of minerals
Covellite: associated with chalcocite
Galena: in small amounts
Malachite: coatings, flakes; fluorescent
Marcasite: uncommon
Metatorbernite: small flakes; fluorescent



Geologic Map

Metazeunerite: rare
Uranophane: rare
Uranospinite: rare

Note: Most uranium minerals are not visible in hand specimen but are indicated by radioactivity.

GEOLOGY

The copper-uranium minerals occur as relatively thin, discontinuous lenses or layers which are sandwiched in between great thicknesses of reddish-brown sandstones and shales. The copper-uranium bearing sandstone and shale lenses are distinguished by their gray-green color contrasting strongly with the red layers. The gray-green lenses also contain black fossil plant remains. Copper-uranium mineralization is generally associated with these fossil plant fragments.

SIMILAR OCCURRENCE

Mauch Chunk uranium, Carbon County

REFERENCES

Klemic, Harry and others (1963), *Geology and uranium occurrences of the northern half of the Lehighton, Pennsylvania, quadrangle and adjoining areas,* U. S. Geol. Survey Bull. 1138, p. 1-97.

McCauley, John F. (1961), *Uranium in Pennsylvania,* Pa. Geol. Survey, 4th ser., Bull. M 43, 71 p.

——— (1957), *Preliminary report on the sedimentary uranium occurrences in Pennsylvania,* Pa. Geol. Survey Progress Report 152, p. 1-22.

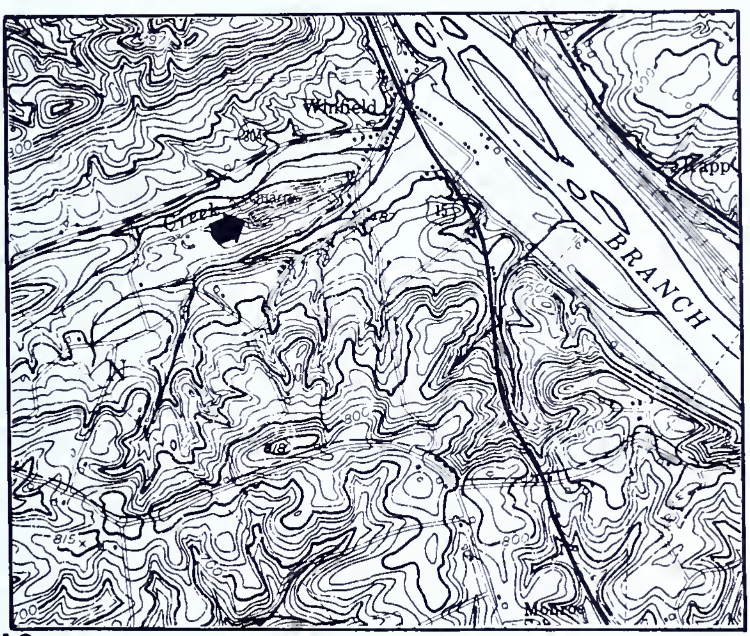
Montgomery, Arthur (1954), *Uranium minerals of the Mauch Chunk area,* Pennsylvania, Pa. Academy of Science, v. 28, p. 102-110.

UNION

WINFIELD QUARRY STRONTIANITE LOCALITY

LOCATION

The Winfield area in Union County offers excellent collecting for carbonate minerals. The limestone quarry approximately one-half mile southwest of town is an active operation and permission to collect must be obtained from the owners. It would be advisable to park your car at the entrance to the quarry and walk to the best collecting spot, about half the length of the quarry along the dip slope of the north wall. You will find this quarry clearly marked on the topographic map of the Sunbury quadrangle, in the center rectangle. Permission must be obtained and a release signed before collecting.



MINERALS

Aragonite: radial crystal tufts; white fluorescence; uncommon
Calcite: in vugs; nailhead and scalenohedral crystals
Celestite: blue to almost clear, colorless crystals in vugs and vein seams

Dolomite: rhombic crystals and cleavages; may be pinkish in color
Fluorite: purple cleavages; crystals rare; in calcite
Galena: cleavages; cubes are rare; with sphalerite, calcite
Limonite
Pyrite: highly modified cubes or incrustations with sphalerite, calcite
Quartz: massive vein material
Rhodochrosite: dark pink coating on limestone
Siderite: generally massive
Sphalerite: small, dark to red to yellowish red; massive and crystals usually striated; with calcite and galena; older (?), lower iron variety is orange, usually in cleavages
Strontianite: clusters of small, white radiating crystals

GEOLOGY

The limestones in the quarry are the Keyser and Tonoloway Formations, Silurian rocks about 430 million years old. Vugs and solution channels have been the site of deposition for the carbonate minerals like aragonite, dolomite, and calcite. This continuous process is, first, one of leaching of limestone, second, the solution of the leached rock materials into percolating ground water, and finally mineral deposition from the ground water as a result of chemical supersaturation. Thus the same process is responsible both for the cavity openings and the crystal fillings in the limestone. However, the solution part of the process is more rapid than this later secondary crystallization. Other minerals, such as fluorite, sphalerite, and galena probably represent a different mode of crystallization from a source at depth by means of heated (hydrothermal) solutions. This type of mineralization is most common along the bedding plane contact of the Keyser limestone with the underlying Tonoloway limestone.

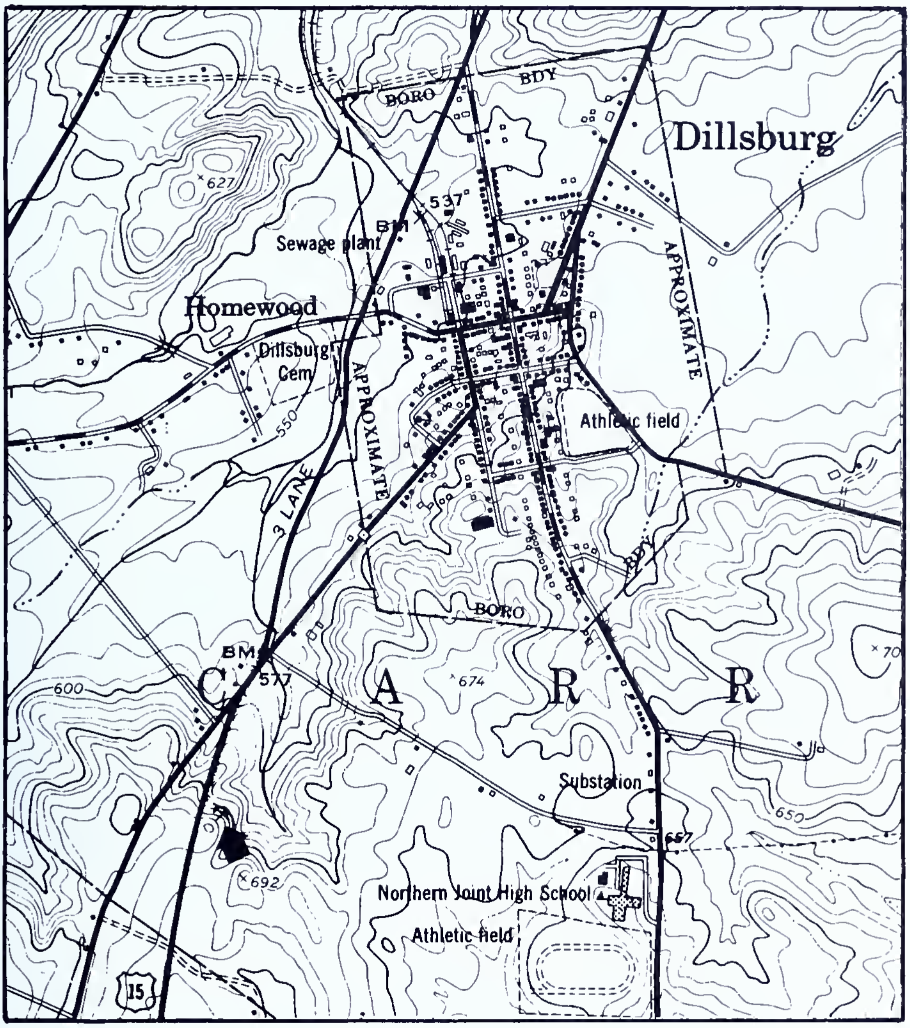
SIMILAR OCCURRENCES

Bridgeport Dolomite quarry, Montgomery County
Showalter quarry, Lancaster County
Medusa quarry, York County

YORK

DILLSBURG ZEOLITE LOCALITY

LOCATION



This collecting locality, located approximately one-half mile south of the Borough of Dillsburg, occurs at the top of a south-dipping Triassic diabase sheet. U. S. Route 15 bisects this locality and collecting is equally good on both sides of the road at the spot marked on the above map. This location may be found on the north-central rectangle of the Dillsburg 7½-minute quadrangle.

MINERALS

Analcime: small crystals, rare
Apophyllite: small crystals with zeolites; rare
Calcite: crystals and cleavages with zeolites
Chalcopyrite: small tetrahedrons; rare
Chlorite: (vermiculite?) ; green to brown; fine-grained
Fluorite: small blue cubes associated with calcite, zeolites
Laumontite: small crystals with natrolite
Leonhardite: small crystals with natrolite
Montmorillonite (?) : associated with chlorite-vermiculite
Natrolite: small, prismatic needles; uncommon
Pyrite: small crystals
Quartz: vein and small crystals
Sphalerite (?)

GEOLOGY

All the listed minerals occur as vein fracture fillings in the top part of the igneous diabase. The form of the diabase is called a sheet because it is tabular in shape and intruded along the bedding planes of the surrounding rock. It is the same diabase with which, at other locations, magnetite ore is associated. Here calcium and sodium have been leached from the diabase, probably by hot solutions (hydrothermal) , during the last stages of solidification of the diabase. This leaching, combined with water, carbon dioxide, fluorine, and sulfur, is responsible for most of the minerals in the fractures. The age of the diabase is Triassic, about 190 million years old.

SIMILAR OCCURRENCES

Teeter quarry, Gettysburg, Adams County
Kibblehouse quarry, Perkiomenville, Montgomery County

REFERENCE

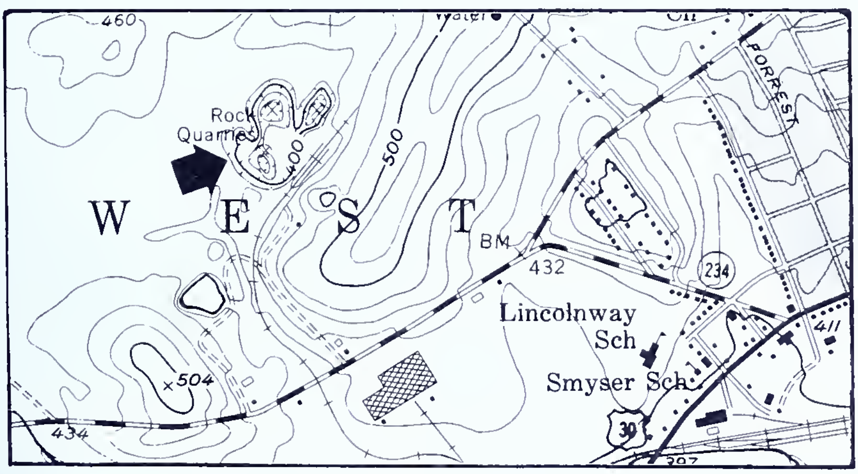
Lapham, Davis M. (1963) , *Leonhardite and laumontite in diabase from Dillsburg, Pennsylvania,* Am. Mineralogist, v. 48, p. 683-688

LOCALITY NOW CLOSED TO COLLECTING

MEDUSA CEMENT COMPANY QUARRY CALCITE LOCALITY

LOCATION

The quarries of the Medusa Cement Company are located along Route 234 approximately 1 mile west of the city of West York. These quarries may easily be spotted in the central rectangle of the West York 7½-minute quadrangle. Most of the minerals listed are not abundant. Permission to collect in the quarries or on the dumps must be obtained from the Company's office.



MINERALS

Aurichalcite: blue crystal aggregates; associated with malachite
Azurite: very small crystals
Calcite: crystals of varying habit, often dark brown and limonite-stained, resembling siderite
Chalcocite (?): dark, black, massive
Chalcopyrite: small tetrahedrons
Dolomite (?): crystal rhombs in quarry nearest the highway; probably all are limonitic calcite rhombs
Galena: cleavages
Limonite: pseudomorphs after pyrite; generally small
Malachite: crystal needles and coatings

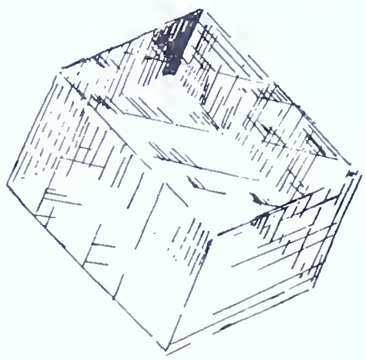
Marcasite: associated with wurtzite
Quartz: small crystals
Sphalerite: unusual very pale green crystals resembling prehnite; also dark greenish brown; on calcite; rare
Wurtzite: pyramidal crystals associated with marcasite and copper minerals on calcite; type: probably 4H, possibly 6H

GEOLOGY

This operating quarry is in the Kinzers limestone of Cambrian age which is about 550 million years old. The minerals here crystallized in several different ways. The calcite and dolomite of the rock are primary sedimentary minerals. The sulfides of copper, iron, lead, and zinc are primary minerals from an igneous source and were brought to their present site by hydrothermal solutions, depositing in fractures in the rock. Thus they are younger than the Kinzers limestone. Weathering (chemical erosion) has since acted on both limestones and sulfides to produce secondary minerals such as calcite crystals, aurichalcite, malachite, azurite, and limonite. These are the youngest minerals and are still forming today.

SIMILAR OCCURRENCES

Bridgeport quarry, Montgomery County
Showalter quarry, Lancaster County
Thomasville quarry, York County



Calcite Rhombohedron

REESERS SUMMIT GARNET LOCALITY

LOCATION

This locality is along Interstate Route 83 just south of Harrisburg. If you are traveling south on Interstate 83, proceed through the Lemoyne and New Cumberland interchanges and cross the Pennsylvania Turnpike about one mile south of New Cumberland. Shortly after crossing the Turnpike there is an overpass and a long hill ahead. This mineral collecting locality is located

approximately 0.8 mile beyond this overpass. Fairview Church is located on the left side of the highway on top of the hill. This locality is in the west-central rectangle of the Steelton 7½-minute quadrangle. There is also good collecting just south over the hill on the benches cut into the highway, and southwest along the slopes of the ridges parallel to the diabase contact.

MINERALS

Amethyst: in the Triassic conglomerate, uncommon
Chabazite: small crystals
Chalcedony: banded milky to yellow
Epidote: small crystals
Garnet: green dodecahedrons, probably andradite, up to one inch or more in diameter, lustrous specimens uncommon
Hyalite opal: fluoresces green
Malachite: small needles in the Triassic conglomerate
Prehnite: on fracture planes; uncommon
Quartz: uncommon in crystals
Tremolite: greenish-gray crystal blades up to one-inch long

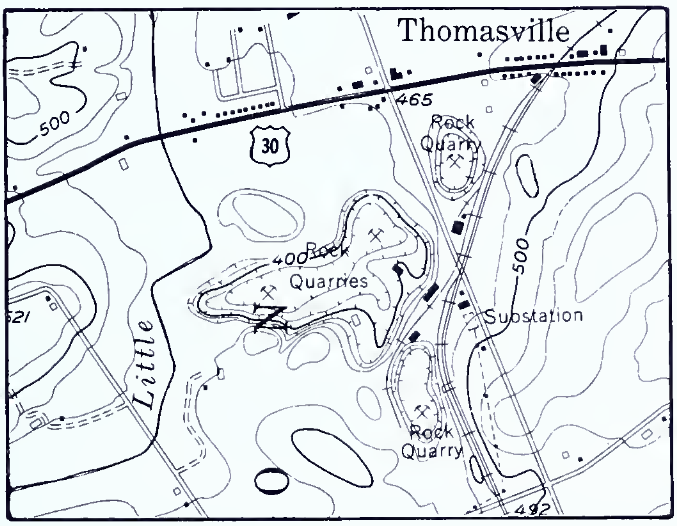
GEOLOGY

The garnet occurs at and near the contact of an igneous diabase dike cutting quartz pebble conglomerates of Triassic age (about 190 million years old). The garnet is found around the quartz pebbles (some amethystine) in small vugs and as massive garnet in fracture fillings. As a result of this intrusion of diabase into the conglomerates, a wide zone of the conglomerate directly adjacent to the diabase was metamorphosed by heat from the solidifying diabase. During the metamorphism of the conglomerate the garnets, tremolite, and epidote were formed near the edge of the diabase. The chalcedony, amethyst, opal, prehnite, and malachite occur in the conglomerate up to several hundred feet from the diabase.

THOMASVILLE CALCITE LOCALITY

LOCATION

The Lincoln Stone Company quarries are located along Route 30, 5.5 miles southwest of West York, just south of the town of Thomasville. The area is located in the west-central rectangle of the West York 7½-minute quadrangle. Permission must be obtained to collect on the dumps.



MINERALS

Calcite Crystals: modified scalenohedrons up to 14 inches in length, yellow to clear; faces often etched; sceptered crystals; some are fluorescent; may be limonite coated; twins are the common $01\overline{1}2$ twins and the rare $10\overline{1}1$ rhombohedral twin with a pseudo-orthorhombic cross section

Chalcopyrite: small tetrahedrons on calcite

Dolomite: generally massive white and pink

Fluorite: generally massive purple; also on calcite

Hematite: occasional minute flakes on and in calcite

Limonite: oxidation product as a surficial coating

Marcasite: small coxcomb crystal groups
Pyrite: small pyritohedrons
Quartz: small crystals and massive; crystals rarely elongated hexagonal prisms

GEOLOGY

The calcite and other associated minerals are found in a sedimentary rock called dolomitic limestone. The high calcium-carbonate and magnesium-carbonate content of this rock makes it a very suitable geologic environment for the deposition of calcium-carbonate crystals in the form of calcite, and calcium-magnesium-carbonate crystals as dolomite. Solutions passing through the dolomitic limestone dissolved some of the rock, and then these solutions redeposited their mineral content as calcite and dolomite crystals along open fractures and in cavities within the rock. The presence of pyrite, chalcopyrite, and fluorite indicate that not all of the chemical elements came from the dolomitic limestone, but that some elements were introduced into the rock, probably by heated (hydrothermal) solutions from depth.

Many of the calcite crystals exhibit multiple periods of growth. As a result the crystals appear banded with varying shades of yellow, white, and brown, some of which are fluorescent. Most unusual are the interpenetration twins (often erroneously called "positive" and "negative" crystals) in which the termination of one is inset into the termination of the other.

SIMILAR OCCURRENCES

Bridgeport quarry, Montgomery County
Medusa quarry, York, York County
Showalter quarry, Lancaster County

MINERALS ORIGINALLY DESCRIBED FROM PENNSYLVANIA LOCALITIES

The following minerals have been named from Pennsylvania localities. Those which are discredited or not valid mineral species are noted with the correct name in parenthesis. The group name for varieties of minerals is noted as (var.).

Celestite: Bellwood, Blair Co.

Cr-antigorite (var. serpentine): Wood Mine, Lancaster Co.

Euphyllite (paragonite plus chlorite): Unionville, Chester Co.

Genthite (probably Ni-deweylite, var. serpentine): Texas, Lancaster Co., (Wood Mine)

Jefferisite (Vermiculite): Brinton Quarry, West Chester, Chester Co.

Lansfordite: Nesquehoning, Carbon Co.

Nesquehonite: Nesquehoning, Carbon Co.

Philadelphite (Biotite-Vermiculite): Wayne Junction, Philadelphia

Rhodophyllite (Kammererite): "Texas, Pa." (Wood Mine, Lancaster Co.)

Sauconite (var. montmorillonite): Saucon Valley, Lehigh Co.

Williamsite (antigorite, var. serpentine): West Chester, Chester Co.

NEW MINERALS FROM PREVIOUSLY DESCRIBED LOCALITIES

The following list of minerals have not been previously recorded by Gordon (1921) or by Lapham and Geyer (1959) at the localities listed. The list includes all minerals identified by the Pennsylvania Geological Survey through September 1963.

Brinton quarry, West Chester Co.
brucite, hydromagnesite, limonite after pyrite, tremolite

Cedar Hill quarry, Lancaster Co.
albite, artinite, aurichalcite, bloodstone, cacoxenite, dolomite, heazlewoodite, kammererite, lizardite, malachite, opaline silica, prase, pyroaurite, pyrolusite, sepiolite (?), stevensite (?)

Coatesville Pegmatite, Chester Co.
beryl, biotite, chlorite, dumortierite, garnet, kaolinite, muscovite, pyrrhotite (nearby), vermiculite

Cornog Keystone quarry, Chester Co.
actinolite, albite, apatite, clinozoisite, copper, gypsum, hemimorphite, orthoclase, prehnite, sphalerite, tourmaline (dravite and schorl), vanadinite

Cornwall mine, Lebanon Co.
anorthoclase, antigorite, apatite, biotite (?), brucite, chalcanthite, chrysotile, clinozoisite, datolite, elbaite, enstatite, epidote, Fe-orthoclase, galena, hypersthene, ilmenite, laumontite, marcasite, melanterite, millerite, Mn-muscovite, pyroaurite, pyrrhotite, rutile, scheelite (?), sphene, stilbite, vermiculite, wurtzite

Dillsburg, York Co.
analcime, apophyllite, calcite, chalcopyrite, chlorite, fluorite, laumontite, leonhardite, montmorillonite, natrolite, pyrite, quartz, sphalerite (?)

French Creek, Chester Co.
erythrite, graphite, ilmenite, stilpnomelane

Friedensville, Lehigh Co.
aragonite, spinel (?)

Glendale, Delaware Co.
ilmenite

Hummelstown, Dauphin Co.
garnet, hematite, quartz

Kibblehouse quarry, Montgomery Co.
actinolite, aragonite, chalcopyrite, chlorite, clinozoisite, epidesmine, magnetite, malachite, montmorillonite (or nontronite), orthoclase, pyrite

Morgantown mine, Berks Co.
actinolite, antigorite, apophyllite, calcite, chalcopyrite, chlorite, epidote, galena, garnet, gypsum, hematite, magnetite, muscovite, natrolite, phlogopite, pyrite, pyrrhotite, sphalerite, sphene (?), stilbite, tremolite

Reesers Summit, York Co.
amethyst, chabazite, chalcedony, epidote, garnet, hyalite opal, malachite, prehnite, quartz, tremolite

Showalter quarry, Lancaster Co.
analcime

Sinking Valley, Blair Co.
fluorite

Sparvetta-Keystone quarries, Chester Co.
aragonite, deweylite, dolomite, hematite, magnetite, orthoclase, talc

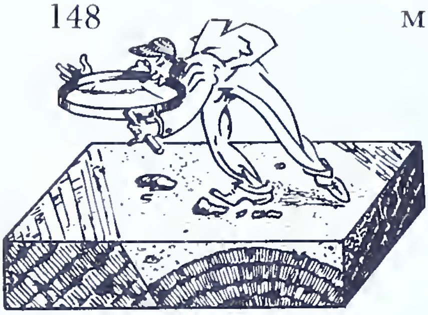
Teeter quarry, Adams Co.
chabazite, epidote, hematite, heulandite, limonite, pectolite, pyrolusite, stilbite

Winfield quarry, Union Co.
aragonite, calcite, celestite, dolomite, fluorite, galena, limonite, pyrite, quartz, rhodochrosite, siderite, sphalerite, strontianite

Wood Chromite mine, Lancaster Co.
dolomite, pyroaurite

York quarry, York Co.
aurichalcite, azurite, calcite, chalcocite (?), chalcopyrite, dolomite, galena, limonite after pyrite, malachite, marcasite, quartz, sphalerite, wurtzite

Miscellaneous
Anatase: southwestern Lancaster Co.
Barite: between Van Wirt and Oakland Mills, Juniata Co.
Natrojarosite: between Bowmanstown and Perryville
Pectolite: Wagoners Gap, Cumberland Co.
Stilpnomelane: southwestern Lancaster Co.



ADDITIONAL READING

Getting Acquainted with Minerals, by George L. English and David E. Jensen; McGraw-Hill Book Company, 330 West 42nd Street, New York, 36, N. Y.; 1959; 362 p.; $6.95.

Gemstones of North America, by John Sinkankas; D. Van Nostrand Company, Inc., 120 Alexander Street, Princeton, N. J.; 670 p.; 1959; $15.00.

Mineralogy for Amateurs, by John Sinkankas, D. Van Nostrand Co., Inc., Princeton, N. J., 1964; $12.50.

Gem Hunter's Guide, by Russell P. Macfall; Science and Mechanics Publishing Co., 450 E. Ohio Street, Chicago 11, Illinois; list of about 1000 collecting localities; 1958; $3.95.

Earth for the Layman, American Geological Institute, 2101 Constitution Ave., N. W. Washington 25, D. C.; this publication lists nearly 1400 popular books on geology and related subjects principally for science teachers, librarians, youth, hobbyists, and those who enjoy geologic literature as an avocation; $1.00.

Popular Gemology, by Richard M. Pearl; Sage Books, 2679 S. York Street, Denver 10, Colorado; 1958; $4.00.

Field Guide to Rocks and Minerals, by Frederick H. Pough; Houghton Mifflin Co., N. Y.; 1955; $3.95.

Rocks and Minerals, by Herbert S. Zim and Paul R. Shaffer; Simon and Schuster, Inc., Rockefeller Center, New York 20, N. Y.; 1957; cloth bound $2.50, paper bound $1.00.

How to Know the Minerals and Rocks, by Richard M. Pearl; McGraw Hill Book Co.; 1955; $3.50.

The Book of Mineral Photographs, by B. M. Shaub; Benjamin M. Shaub, Publisher, 159 Elm St., Northampton, Mass.; 1957; $1.68.

The Mineralogy of Pennsylvania, by Samuel G. Gordon; Special Publication No. 1, The Academy of Natural Sciences of Philadelphia; 1922.

The Mineralogy of Pennsylvania (1922-1965), by Arthur Montgomery; Special Publication No. 9, The Academy of Natural Sciences of Philadelphia; 1969.

All About our Changing Rocks, by Anne Terry White; Random House; for younger rockhounds, 10- to 14-year-olds; 1955; $1.95.

Rocks and Minerals and the Stories They Tell, by Robert Irving; Knopf & Co.; for the 8- to 12-year-old group; 1956; $2.75.

Rocks and Minerals, by Richard M. Pearl; Barnes & Noble; 1956; $1.95.

Crystal and Mineral Collecting, by W. A. Sanborn, Lane Book Co., Menlo Park, Calif.; 1960; $3.50.

Seaman's Mineral Tables, by Kiril Spiroff, Michigan College of Mining and Technology Press, Houghton; 1959; $2.00.

Rocks and Minerals Magazine, published bi-monthly, Peter Zodac, editor and publisher, Official magazine of the Eastern Federation of Mineralogical and Lapidary Societies; Box 29, Peekskill, N. Y.; subscription $3.00 a year.

Handbook of Gem Identification, by Richard T. Liddicoat, Jr., Gemological Institute of America, 11940 San Vicente Boulevard, Los Angeles, California; $6.00.

Gemstones and Minerals, How and Where to Find Them, by John Sinkankas, D. Van Nostrand Co., Inc., Princeton, N. J. 1961; $8.95.

MUSEUMS IN PENNSYLVANIA DISPLAYING ROCKS AND MINERALS

Allegheny College, Department of Geology, Meadville

This college has a small display of rocks and minerals in hall cases.

Audubon Shrine Museum, Phoenixville

Very good display of copper minerals from the area; especially excellent collection of minerals from the Ecton Mine.

Bradford County Historical Society, Court Street, Towanda

The museum of the Bradford County Historical Society has a fair collection of minerals and fossils collected during the era of the Second Geological Survey of Pennsylvania (1874-1887).

Bryn Mawr College, Mineral Museum, Department of Geology, Bryn Mawr

The mineral museum at Bryn Mawr College is an excellent one. The minerals are displayed in one large room in well-illuminated glass cases, and in cases throughout the hall. The recently acquired George Vaux collection was one of the outstanding private collections in the eastern United States.

Carnegie Museum, 440 Forbes Street, Pittsburgh

This museum has a large collection of excellent minerals, which is by far the best collection in western Pennsylvania. From time to time, the Carnegie Museum has special displays of gems and spectacular minerals.

Chester County Historical Society Museum, West Chester

Very large collection is on permanent display.

Delaware County Institute of Science, Media

The Institute has a nice display of Delaware County minerals.

Dickinson College, Carlisle

The mineral collection displayed at Dickinson is in new quarters in the Althouse Science Building and is being expanded.

Erie Public Museum, 356 W. 6th Street, Erie

The Erie Public Museum has a small general collection.

Everhart Museum of Natural History, Science and Art, Scranton

The mineralogy and geology collections of the Everhart Museum are small.

Lafayette College, Department of Geology, Easton

The Department of Geology at Lafayette College has a display of minerals in individually lighted glass cases throughout the hallways and a large research collection.

Lehigh University, Department of Geology, Williams Hall, Bethlehem

The Department of Geology at Lehigh University has several large display cases with rocks, minerals, and fossils on exhibit at all times. The display cases are arranged through the halls of the Geology Department building.

North Museum, Franklin & Marshall College, College Avenue, Lancaster

The North Museum in Lancaster has devoted at least one-third of its space to the display of rocks, minerals, fossils, and geologic exhibits. The museum has an excellent collection of local (Lancaster County) minerals.

Pennsylvania University, Mineral Collection, Department of Earth Sciences, College Hall, Philadelphia

The University of Pennsylvania's collection is small. They have one or two hall cases plus several room display cases in the Department.

Pennsylvania State University, College of Mineral Industries Museum, University Park

Penn State University has an excellent museum of minerals, rocks, and fossils. It is the best in central Pennsylvania. Their mineral collection is displayed in a large room and throughout the halls within the Mineral Industries building.

Philadelphia College of Pharmacy and Science, 43rd, Kingsessing & Woodland Avenues, Philadelphia

The College Museum comprises one spacious room located on the third floor of the college building. There is a small collection of minerals displayed.

Philadelphia Academy of Science, 19th & The Parkway, Philadelphia

The Philadelphia Academy has by far the best display of rocks and minerals in eastern Pennsylvania. A large section of the academy is devoted to this display. They have, perhaps, the best representative collection of Pennsylvania rocks and minerals in the State. In addition to large amounts of excellent material, the minerals are displayed very attractively.

Pittsburgh University, Department of Geology, Pittsburgh

The Department of Geology at the University has minerals displayed in hall cases. They have a fair display.

Reading Public Museum, and Art Gallery, 1101 Museum Road, Wyomissing

The Reading Public Museum's mineral collection is general and fair.

St. Vincent College Museum, Latrobe

St. Vincent College has a fair collection of U. S. minerals and a better-than-average collection of European material. In all they have approximately 5,000 mineral specimens.

Tioga Point Museum, 724 S. Main Street, Athens

The museum has a small display of geological material.

Wagner Free Institute of Science, Montgomery Avenue and 17th Street, Philadelphia

The Institute's museum contains permanent exhibits of fossils and minerals. There is also a large study collection of Pennsylvania minerals.

Waynesburg College, Waynesburg

Waynesburg College has a small mineral collection in their museum.

West Chester State Teachers College, Science Museum, Anderson Hall, West Chester

The college possesses a representative display of Pennsylvania minerals, many of which were gifts from the Sharpless, Darlington, and other famous collections. A unique feature of the museum is a group of specimens which includes nearly all the minerals to be found in Chester County.

William Penn Museum, Pennsylvania Historical and Museum Commission, Harrisburg

The new State museum (William Penn Museum) opened in 1965. Geological, mineral, and fossil displays are shown as they are completed.

Wyoming Historical and Geological Society Museum, 69 S. Franklin Street, Wilkes-Barre

The museum has a small general collection of minerals.

York County Historical Society, 225 East Market Street, York

The museum of the York County Historical Society is located in the society building at the above address. It has a small general collection of minerals, rock and fossils.

LOCALITY INDEX

MINERAL INDEX